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ABSTRACT

On Thursday, May 26, 1988, representatives from Federal departments and agencies, education associations, and members of the American Society for Quality Control attended a seminar in Washington, D.C., that proposed, and explored the feasibility of, a National Educational Quality Initiative. This document comprises the proceedings from this conference, along with an administrative summary. After a seminar agenda and three welcoming addresses by seminar cochairmen and an official from the U.S. Department of Education, three major presentations are included. "Broad Overview of Quality" by W. A. J. Golomski defines the "quality sciences" and emphasizes the importance of voluntary standards of quality to education. "Quality Service and Staff in a Training Environment" by A. B. Godfrey discusses the principles of quality planning, quality control, and quality improvement in business, and shows how these principles can be applied to classroom instruction. "Software Quality Fundamentals" by V. R. Basili discusses the problems involved in assessing software quality and argues for a goal-oriented approach to managing and engineering software development. Included is a question-and-answer session for the presenters' panel, followed by a panel wrapup and identification of following effort. (TE)

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Report of the Seminar
Cosponsored by the
Federal Interagency Committee on Education
and the
American Society for Quality Control
Proposing a
National Educational Quality Initiative

Thursday, May 26, 1988

National Guard Association Auditorium
One Massachusetts Avenue, N.W.
Washington, D.C.

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UNITED STATES DEPARTMENT OF EDUCATION
OFFICE OF THE DEPUTY UNDER SECRETARY
FOR INTERGOVERNMENTAL AND INTERAGENCY AFFAIRS

AGENDA

NATIONAL EDUCATIONAL QUALITY INITIATIVE SEMINAR

May 26, 1988

National Guard Association Auditorium
One Massachusetts Avenue, N.W.
Washington, D.C.

0830-0900 Registration

0900-0905 Introduction by Seminar Co-Chairmen

LeRoy Walser, Executive Director
Federal Interagency Committee on Education
U.S. Department of Education

Frank Caplan, President
Quality Services, Inc., and
Fellow, American Society for Quality Control

0905-0915 Welcome

Dr. Peter R. Greer, Deputy Under Secretary
Office of Intergovernmental and Interagency Affairs
U.S. Department of Education

0915-1100 Presentation: BROAD OVERVIEW OF QUALITY

Dr. W.A. Golomski, President
W.A. Golomski & Associates

Professionals are somewhat unique in that their bodies of knowledge are well-defined. Occasionally a new concept or discipline comes along which appeals to them. The quality sciences have been explored by those in education more as an observer than a player. Of course, many of the concepts and practices are now embedded in education. There is a desire for understanding of these concepts in a formal systematic way rather than in bits and pieces.

The purpose of the presentation is to discuss:

1. What the quality sciences are;
2. The importance of quality sciences to the nation and education in particular; and,
3. The importance of voluntary standards efforts and their value to the educational effort.

1100-1130 Break

1130-1230 Presentation: QUALITY OF SERVICE AND STAFF IN A TRAINING ENVIRONMENT

Dr. A.B. Godfrey, Chairman
Juran Institute

During the 1980's American companies have made major strides in understanding how to manage quality. First applied in the manufacturing industries, these quality management principles are now widely used in the service industries and in managing the basic business processes. These basic principles or concepts are quality planning, quality control and quality improvement.

Recently, these basic principles have been applied by professors and teachers to improve the quality of teaching. While "quality management" of instruction of this type is still in its infancy, the early results are encouraging. In this presentation we shall attempt to clarify these principles and explore how they may be used to improve the quality of classroom instruction.

1230-1330 Lunch

1330-1415 Presentation: SOFTWARE QUALITY FUNDAMENTALS

Dr. V.R. Basili, Chairman
Computer Sciences, University of Maryland

This seminar discusses the problems involved in assessing software quality, their causes, and the weaknesses in the standard software life cycle with regard to achieving software quality.

It argues the need for a goal-oriented approach for managing and engineering the software development and maintenance process that supports a quality-oriented software life cycle. The approach is based upon the use of models of the various processes and products and the use of quantitative and qualitative measures.

1415-1500 Q & A Session for Presenter's Panel

1500-1600 Panel Wrap-up / Following Effort Identification

Mr. Spenser Hutchens, President-Elect
American Society for Quality Control

Ms. Virginia Robinson, Education Writer and Editor
National School Volunteer Program

Dr. D. Kay Wright, Acting Deputy Assistant Secretary
Office of Vocational and Adult Education
U.S. Department of Education

Introduction

Frank Caplan:

My name is Frank Caplan, and I am chairman of the Long Island Section of the American Society for Quality Control and co-chairman of the seminar. The other co-chairman, Mr. LeRoy Walser, of the Department of Education, will be speaking to you in a few minutes.

I would like to give a little background for this session as well as I can at this stage. Because of the almost total lack of knowledge of the critical nature of how to achieve quality on the part of our national work force at all levels of business, industry, government, and institutions, and because of the resultant waste of money, time, limited natural resources, and because of our declining competitive position in domestic and world market places, there is a need to incorporate appropriate portions of the Quality Sciences into every course taken in every school, from kindergarten through graduate school, and in continuing education.

The first extensive speaker this morning, Bill Golomski, has reminded me there are some states that have formal pre-school programs which should have Quality Sciences started there.

I have been working on this concept and attempting to obtain participation by state and national organizations. The chap who got me involved in this at the beginning unfortunately could not be with us today. His name is Mr. Stanley Seifer. He is Director of the Long Island Quality Institute, which is the educational arm of the Long Island Section of the ASQC. His wife is ill, and he was unable to get away, but I wanted you to understand that while I have been much in the forefront of this effort for the last six years, this was all originally Stanley's idea. He didn't have to sell me very hard.

We have three principal speakers today, Mr. Golomski, Dr. Godfrey, and Dr. Basili. Each of you have or have available to you a biographical sketch of each of these gentlemen and so, in the interest of time and getting as much of the message across as we can, we will forego any extensive introduction of these individuals, but I think it is important that you should recognize that all of them, directly, immediately, and totally or to a significant degree at least (as well as myself and other speakers from the ASQC that you may hear today or see at the breaks and at lunch) are involved in education.

The American Society for Quality Control was founded in 1946 as the outgrowth of War Production Board courses that were given during World War II by college professors who were involved particularly in the area of applied statistics in industry because the War Production Board was confident the American effort in World War II had to be supported by all possible tools and recognized that this was an extremely valuable one. Groups formed as a result of these courses and they ultimately joined together in 1946 to form ASQC.

The point I want to make with this very brief history of an outstanding organization is that it was founded as a result of educational effort, it has been dedicated since its inception to education in all areas associated with the subject of quality, and in the last eight years has come to considerable prominence in the area of quality worldwide.

So we are not unaware of the educational concerns and we are fully convinced that the only solution to our problem for the long term, our whole societal problem, is the question of quality. So we would like to encourage you to listen to what we have to say in that regard.

At this stage I would like to turn the meeting over to my co-chairman, Mr. LeRoy Walser, Executive Director of the Federal Interagency Committee on Education. LeRoy.

Introduction

LeRoy Walser:

I also would like to welcome you to this important meeting. ASQC has dedicated itself to the pursuit of quality, and education seems always to be pursuing excellence. This meeting, we hope, will set up the groundwork for considering, nationally, issues of quality that affect education.

Now, I have the distinct privilege and opportunity of introducing to you today Dr. Peter Greer, who is the Deputy Under Secretary for the Office of Intergovernmental and Interagency Affairs in the Department of Education. It has been a real opportunity to work with Dr. Greer, an insightful man, a man who has a lot of motion and direction to him, and it has been a pleasure to work with him.

Without giving an awful lot of background about Dr. Greer, who has been involved in education professionally, I guess all of his life, as superintendent of schools, as a director of national projects before he came to the Department of Education, and now is a very influential and hardworking man whom I respect. Dr. Greer.

Welcome

Dr. Peter R. Greer:

That is one of the nicest introductions I have received in a while. I also can caddy. I was a Triple A caddy at the Broadmoor Golf Course in Colorado Springs. Other than that, I can't do another thing.

This is a cameo appearance not because my time is so valuable and yours is not, but because I just returned from Montevideo, Uruguay. I was there a week working with eleven nations on the drug problem, so I am unable to do my job and spend an entire day on this important topic. But, LeRoy Walser insisted that I be here to open the session, and I always do what LeRoy tells me to do.

I am therefore the loser, and you are the smart ones. In other words, you have the good instincts that this topic may be an important one, that the quality sciences have implications for education. You may be pioneers today. All of us go to conferences, day after day, or week after week. Some of them really don't make a difference, but it is important that we be there. This one may make a difference. So I think you will find this exciting.

In looking at the the pre-registrations, there seems to be a good diversity of groups, and this is vintage FICE. FICE, as you know, the Federal Interagency Committee on Education, has the job of bringing together various agencies, both federal and non-federal. I noticed on the pre-registration list that we have both, at least in the pre-registration. I don't know most of you. I am guessing that if you pre-registered, you showed, and again, congratulations for being pioneers. Hopefully at lunch you will talk to each other about this topic, and you will meet new people, and a lot will come out of that.

Now, why is this topic potentially important? I wasn't going to say, this topic is not important, I don't know why you are here. I wasn't going to say that, but what is my argument that this is an important topic?

Well, first of all, quality in education is missing. We all know that. It is missing in general. I mean, a few years ago someone named Fenwick English came up with the idea of mapping out what you are teaching in the classroom and in the curriculum; people went crazy. He picks up about $2000 a speech helping schools to map out what they are doing. We are in trouble in terms of quality in education.

When we find out that the testing--when a West Virginia doctor finds out that the testing programs in most schools are a little faulty, and that everyone is above average, we are in trouble. We are in trouble in some way and quality is needed.

When the United States spends $310 billion a year on education, 7 percent from the federal government, 50 percent from the states, and 43 percent from the local taxpayers, and yet we come out last or next to last or in the middle of the pack in biology, physics, chemistry, and most other indicators, when China and Japan--when we stay with China and Japan until about the fifth grade, and then they just move right past us, maybe that is a question of quality.

When the public is demanding quality, when they are saying, we will pay more but we want to see some results, then the idea comes in that perhaps quality control, quality sciences, are really important. When teachers are confused and everyone is complaining about top down, bottom up, middle out, and people are spinning around, maybe this topic is really important, and my argument would be that.

You have the reform movement, which makes this topic a very important one. Secretary Bennett, as you know, presented his homework assignment to President Reagan on April 26th, what has happened in the last five years, and the result is that we have a reform movement, but we don't see the results.

So again, I think it is timely to talk about this topic. If LeRoy had put this idea together with the other gentlemen prior to "A Nation At Risk", or even three years ago, perhaps it wouldn't be timely. It is timely right now.

Why? Accountability and assessment are buzzwords, but important words, in terms of what is going on in education. You have such things as state report cards, assessing schools against one another on a series of criteria. You have community report cards looking at such things as student attendance, teacher attendance, dropout rates, test scores, things of that sort. You have the career ladders and merit. You have to have criteria, and that is the big thing. When teachers say I don't want anything to do with merit plans or career ladders, it is because of the criteria and who is doing the evaluation. In other words, the quality evaluations are really important.

You have evaluation of personnel. Principals have to be evaluated better. Superintendents have to be evaluated better. Teachers have to be evaluated better, and with fairness, and when you say fairness, you are not talking about some mystical term, you are talking about criteria. You are talking about quality criteria.

You have a National Teachers' Board, 63 people who will be struggling to come up with ways to transfer quality criteria and quality teachers and the certification across state lines.

You have the Association of School Business Officials trying to come up with certification, with quality control within their own ranks. You have superintendents and principals trying to come up with quality control in their own ranks.

Why? Well, probably because you have a National Teachers' Board, and they don't want to be left behind so that only teachers are seen as professional. You even have such quality control and quality criteria needs as those found in New Jersey. They will probably be taking over a school system. This will be the first time, perhaps in the history of the United States, where a state has said, you are so bad school system, in this case Jersey City, that we are going to take you over. And what happens when there is a takeover, based on criteria, based on evaluation, based on lack of quality? They fire the superintendent, they fire the superintendent's associates, and they fire the school board.

So, to do something like that you have got to be sure about what you are doing, if this Jersey City takeover works, there are four other states that have the same thing on the books, Arkansas, South Carolina, and I can't remember the other two. We want to have quality in this, too, so there is fairness, so that there is fairness.

It is one thing to be toughminded. It is one thing to be bold. But you have to be fair also, and this is where quality comes in.

Then you have technology. There is the whole area of technology in terms of the software. Technology has an impact on equity, on all students being able to perform in the basics. It has done more than other attempts in terms of teacher attendance, student attendance, fewer drop-outs, and kids really learning. I mean, the whole area of technology cries out for quality. You also have business practices. Can we adapt the concept of business practices to school systems? Right now you know that there is great talk about the local level, the small teams as you would find, I guess, making Volvos or something. I never had a car that cost more than $6,000, so I don't know what I am talking about when I talk about Volvos. All of my cars are like my Corvair where I shifted it and I didn't know if I would go forward or backward, which has made me a very tense person, and emotional.

But the business practices of the small groups, the small teams working, this seems to be a fertile area for quality, for the quality sciences. The whole idea of drugs and the materials to prevent drug abuse, and the curricula that can be used, is a fertile ground. I mean, everyone has something to help cure drugs now. When I first came aboard here in Washington, in the Department of Education, I met with a drug-sniffing dog company from Oklahoma, or representatives of that company. Everyone--but how do you choose what is good and what is bad? What is the criteria even for that?

In the famous book from the Department of Education, Schools Without Drugs, page 26 gives you a start on how to ferret out what is good and what is bad, but it is not enough. It is not enough. So here is another potential area.

The whole idea of sharing what works well requires criteria to be used. School people like me were famous in the sixties and seventies for taking on garbage. Garbage. Anything looked good. Here is a textbook on the humanities called The Humanities and You. It looks good to me. I don't even have to look at the table of contents. And everyone knows there is a great controversy on textbooks in general, and that California is trying to do something about it, and leading the league in that. But I mean, even in the examination of textbooks there is a need for the quality sciences.

And how about the whole idea of choice? The entire state of Minnesota now is saying, parents, you can choose any school you want in the entire state, and other states have toyed with that, and two or three have defeated it, such as Colorado. But Minnesota is leading the league in that, and other states are going to do it.

Well, what is the criteria for choosing a school? I think that's a fertile area right there. On what basis do you choose a school?

And then finally I would guess that Secretary Bennett, were he here, would say there is no mystery to a lot of the things that go on in education. Educators try to make things a mystery. Researchers talk to each other. But I think with the use of quality sciences, we can prove that in many ways there is no mystery to what works in education and how we can have a quality education.

So what I am trying to say is, with all these examples, that statistical process control and quality cost and total quality control and failure analysis and zero defects should take on our deep interest all day today. There is an ally out there, I think, called the quality sciences, and maybe this ally, and maybe you through your discussions can show that the quality sciences can be an ally to education, and can help reform education and bring us the educational system that we want for our children.

And finally, I guess, by attending this meeting, what you are doing is that you are saying, let's see if we can will the means to make education better through the quality sciences. I am fond of telling a story about my poor son. The moment he finds out I am telling this story he is going to kill me. But when he was in Little League, back in Maine, he used to strike out all the time, and he used to strike out all the time in the last of the sixth with men on base, usually with the winning run on third base. And the parents would go crazy, and they would call him names, and they would ask who spawned this kid. They were really upset.

And my son would say, gee, Dad, I keep striking out. I said, I know, I know. And he'd say, I wish I could hit better. And I said to him, I'll give up my job, I'll throw 100, 200 balls a night, you'll hit, you'll hit. And he said, I don't want to practice, I just want to hit.

He hadn't realized the difference between wishing and willing, and what you are doing here at this meeting is willing the means of having higher quality education in the United States through the quality sciences, not just wishing the whole thing.

I am going to read the minutes of this meeting very carefully. A lot of paper is put in front of me. I don't always read it. But I am going to be very interested in your conclusions and the results of your conversations. I think that there is a potential, LeRoy, for articles in the national education magazines and others that you all would know about that I don't.

You are going to be listening to a lot of presentations. I hope you ask questions of the presenters. You will be in a wrap-up session, and in this wrap-up session you are supposed to determine the level of interest in the topic of quality as it applies to education. You are supposed to consider ways to proceed afterwards.

In other words, once you leave the door hopefully you won't say, well, that is over, what is the meeting tomorrow or what are the meetings after the Labor Day holidays? What is the follow-up to a meeting of this sort? Will the ways. Don't wish after the meeting.

Mr. Spencer Hutchens and Dr. Kay Wright and Ms. Virginia Robinson are going to be leading the closing discussion, and I hope you come to that with some really first-rate ideas.

So, it is good to be with you. I apologize that I am leaving. I gave you my excuse. I am envious in a sense. Especially after I wrote this speech, I said, you know, this is a good conference.

Maybe I should have rescheduled--maybe I shouldn't be doing the things I am doing for the rest of the week. But that is, again, why I am going to be listening and watching for the results. So, good luck, and have a good day.

Thank you.

Mr. Walser:

Thank you very much, Dr. Greer. We appreciate that introduction.

A couple of little items. In your registration packet you saw this form for questions to the presenters. I think each of you, if yours is like my packet, have three of them. However, you are not limited to three. I would like to introduce George Spicely and Diane Ruffner, who will be runners to gather these questions that you have and to provide you with additional forms, if you need them. I would recommend to you that at this kind of conference and this kind of presentation, it is very useful for the presenters to receive your questions because it gives the presenters another opportunity to talk about things that are important to them.

It is extremely useful to hear from you the kinds of questions, the kind of observations, and the points of possible disagreement. If you would write those down when they occur to you so you don't have to say to yourselves, what was that thought that I had and how does it fit? You can hand them in right then by merely raising your hand like this and holding the form up, and one of the two runners will come by and pick it up and give you another one.

This is going to be a factory production of high quality reaction. And we'd appreciate that kind of interaction from you as the day proceeds. If you have some questions for Dr. Greer, just put Dr. Greer, your remarks about such and such were right on target, or they are off, or whatever you wish to say. Let it flow as we work through this conference. We would appreciate that. And if you have any other questions or any other concerns, please let us know. The FICE staff members are here to support you and your attendance today.

I would like now to turn to Mr. Bill Golomski, who will give his presentation. We will not take a lot of time to talk to you about his qualifications, his biography. It is included in your packet. Please look at it. Please read it. I hope you have read what we call maybe a little teaser in terms of what he will be presenting and talking about. And he is anxious, and he is here, so Mr. Golomski.

Presentation: Broad Overview of Quality

Mr. Golomski:

Thank you very much, LeRoy. Good morning, everyone. It is good to be here with you. I am always delighted to meet with a group of people who are in education and those who are in other parts of government. This is because I have a great respect for the kinds of things you are doing and under the conditions that you are operating.

I am going to talk about two things today. The first has to do with how to look at our work from the perspective of the quality sciences. This is, to what extent can the operation of our various organizations, agencies, departments, and so on be improved using some of these concepts?

Then, the second has to do with how there might be some concepts here that could fit into the educational program starting with pre-school and working its way upward.

And by the way, even though there will be ample time for discussion in the panel, if you have any question along the way that you would like to ask because it is distracting you from what I might say afterwards, simply raise your hand and I will try and answer it at that time.

Now, one of the interesting things is that no matter what the educational level of a person is, there are opportunities for employing concepts of quality improvement. Last night when I checked into the hotel I noticed that a convention of anesthesiologists is meeting here in Washington, and they are going to be talking about a variety of interesting things, I am sure. Very coincidentally, when I was in Orlando earlier this week there was a convention of office managers of anesthesiology practices. It is interesting that the two groups are meeting in different cities. Were I to design a conference, I would hope that somehow those who are in charge of managing the business offices might meet with their professional counterparts some day. But, perhaps, the gaps in the organization chart or the educational backgrounds are so great that they just don't think it's possible for them to meet together.

But anyway, let me tell you my story about anesthesiologists. I was in for my second annual hernia operation a few years ago. With the first one, I had investigated the surgeons carefully and found a fellow who had a marvelous record. So, I decided he is the man who is going to take care of me. What I didn't realize was that he was within six months of retirement; but had I known that I don't think it would have made any difference.

Well, anyway, into the surgery and out into the cardiac care center, and so it turned out that I was allergic to a number of the anesthetics. That hadn't been checked out the night before, even though I had told them and they supposedly made the right selection. The surgery wasn't done well; about 60 percent of the final operations done by that MD before he retired were questionable.

Again, just because someone has done great things in the past is no indication they will in the future. That is one of the things that is very important in the quality sciences. That is, the past is not a sure predictor of the future. The past might be of some help, but we also have to look at some prevention systems.

Now, the interesting thing was, when I went for my second hernia operation, I was in my room the night before surgery. A gentlemen came in with a tray full of pharmaceuticals, and he said, "I am here to give you your shot." I said, "That is rather interesting. I am going into surgery tomorrow morning. I don't know why I need a shot tonight."

He said, "Don't worry, I give these shots without any pain." I said, "That's not the point. I think you are mistaken." And he said, "Well, a lot of people are unhappy about hypodermic needles and all that, but I do this professionally."

I said, "Look, I'll make a deal with you. You look on your chart and tell me what my name is, and then come over and look at my bracelet, and let's see if we can find out whether or not the two match." So he announced my name: "Chung Chu Lee." I said, "That's a nice name. It doesn't happen to be mine." I said, "Why don't you come over and look at my name?" Well, he walked toward me with the hypodermic needle behind his back. I said, "Look, this is a fair game. I am serious." So he put it down, came over, and saw my name. He says, "Oh, I must be in the wrong room, or maybe the patient checked out, or maybe I'm on the wrong floor." And I talked to him, "Look," I said, "don't be so intent on getting rid of all these drugs on your tray, following your schedule. There is a quality aspect to your job as well."

Well, the next morning I was wheeled down into surgery. While I was waiting in the waiting room the anesthesiologist came over to prepare me. She said, "Well, I am going to prepare you for the surgery." I said, "Now, the last time I was in here I had serious problems. Make sure you have the right anesthetic."

And she said to me, "Well, didn't an anesthesiologist talk to you last night?" I said, "No!" She said, "Well, they are supposed to. You have to be in surgery in five minutes." I said, "No, I can be a streaker and run out of this hospital. I don't have to be in surgery."

The interesting thing is, they were more interested in schedule than quality. They had a certain routine of things that had to be done, and I was becoming an obstacle to the routine as they had established it. Even though I was trying to tell them all the things to look at, they filtered out all of the signals. These are the kinds of things that can happen even in systems where you have very bright people. They lose track of what they are really up to. It is the schedule or cost that becomes most important. They lose perspective that there is a quality aspect of what they do.

We are not talking about people at the bottom of the organization chart. We are talking about people who are up near the top of the organization in many cases. By the way, going back to my experience this week, the anesthesiologists here, the managers in Orlando; I should also tell you that I was working with a group of people in medical supply who furnish the anesthetics to the anesthesiologists. They were having their convention in a third place. I wonder if these three groups ever talk to each other.

Try and find out who are the suppliers of information, who are the people with whom you deal, who are those who are part of the system, and what is their role?

Dr. Greer talked about the firm from Oklahoma who wanted to get him interested in the drug-sniffing dogs. What is the problem with that? It is detection of the problem, not prevention. So from the quality sciences point of view, we are not saying detection is bad, we are saying that if you can develop a system that is associated with prevention of a problem, than that is a superior system to one that is concerned with detecting all sorts of errors.

One of the little surveys that I run with just about every group that I talk to is to find out whether there were any errors in your last paychecks. By the way, any errors that anyone here had in their last paycheck? None? Now, the question is, how did that happen? Are there Japanese in the payroll department? How could it happen that Americans did that job so well that not a single person here raised their hand? And why does that system work?

Number One; there is instantaneous feedback. Number Two; you want that system to work. You don't want to blame anyone. You want the system to work. See? Now, why can't we have that attitude toward all our systems? Quick feedback, no retribution; trying hard to make the system to work, rather than concentrating on fixing the blame.

That is an important attitudinal element of anything that has to do with quality.

Oftentimes when we consider doing something in a new way, one of the first things we talk about is to make a needs analysis. We find out whether or not those with whom we work have a need for whatever service or program we are trying to start. That is okay in many cases, but it is not good enough. Let me tell you why a needs analysis is good in some cases and not in others.

First of all, we want to be responsive to citizens, to people in other departments with whom we work, to our customers, to our employees, and even for working well with those who supply us information or whatever. But when there are new concepts around, like concepts of the quality sciences, a needs analysis might not identify all the elements and all the programs and all the systems that could be used to improve quality. So, there are times when you need an expert who comes in from outside the organization to bring in ideas and to look at problems in a way that you never thought of.

And so, I have nothing against needs analysis, but I am saying in many cases needs analysis is not enough. It is not enough.

Let me give you an example. There is a story that was told during World War II about a group of Congressmen trying to decide what to do about shells exploding in the hands of soldiers before the shells got into artillery pieces. And so a group of people in a hearing got together, and there were various suggestions. One was, let's shoot off every other shell to see whether the adjacent ones were okay. The next most senior person on the committee, not to be left out, said, well, we'd lose too many shells that way, why don't we shoot out every fourth one?

And then the next person, maybe every eighth one, and so on, until all that was left to the junior member of the committee was, one to the two whatever power, perhaps fifteenth power. Then they discovered that a legal education is of no help in technical areas. It might be good for negotiation; it might be good for showing your constituents that you are involved. They had no expertise. There was no technology. There was no common sense. It was just an attempt to try and solve the problem.

So there are cases even when you have bright people who are trying to solve problems that you have to find the appropriate expert to try and help solve some of these problems, and sometimes they are hard to find.

Leadership is extremely important also, and in many cases, if you are lucky, the leader can bring in either new ideas or at least make the organization receptive so that it is willing to consider change. And that is very important in the quality area.

Usually when we try to learn how to change an organization we might have certain traditional sources with whom we work. Those of you at the federal level might work with those in other federal agencies. You might work with those at the state level, municipal level, and so on. And that is the domain within which you work.

I was reminded of a potential client who called me one time and said, "Do you know anything about flea collars and tick collars?" I said, "No; what is your problem?" He said, "Well, these boxes of flea collars and tick collars get to the supermarket and occasionally there is nothing in them." And I said, "Well, where does this happen?" He said, "We don't know if they are stolen at the supermarket, or if they are not inserted in the factory, but it is a very serious problem to our industry."

I said, "It has nothing to do with your industry. Any parent who has tried to assemble toys on Christmas Eve and has a little bag of nuts and bolts and screws occasionally discovers that the bag is incomplete. So all of you are talking about here is a problem of why isn't a package complete in the sense of all the things that are supposed to be in it."

He says, "Oh, you don't understand our industry." He said, "This flea collar and tick collar industry is different." Well, the whole point was, he couldn't get himself out of this trap that he had blocked himself in. All he could think about was how specific this problem was to his company; how it was so different from any other company that had it. It was unlikely that anyone could come in there and come up with a solution.

Now, that might be true in some problems, but in many cases the best ideas for any organization come from outside the profession or outside the industry or even outside the country. That is one of the interesting things about how we bring change into organizations. I was told a few blocks away from here we have a Statistical Department at the U.S. Department of Education. I would be surprised if all of the statistical methods used there were developed by people in the educational field. I will bet some of the methods that are used there were developed at Guiness Brewery years ago, when the t test was developed there. I will bet some of the other tests that are used there were developed in agriculture, and in manufacturing, and in research and development, and in communications.

So, one of the interesting things is that departments that are truly effective have learned how to bring in ideas from other places rather than simply to read their own journals and talk with people within their own disciplines. That is one of the reasons we are here today; to simply try and get us to think about how we can learn from other disciplines.

Another important concept in the whole quality area is, we like to get people to understand that when we assign them to a job or when we hire them, that they really have two jobs. The first is to do whatever your job description says you are supposed to do. And then the second is to improve on it! And in some cases the improvement might even result in the elimination of that job.

Let me give you an example. I was doing some work for a company that processed credit cards. They had asked me to give them a talk about productivity improvement in this credit card business. I said, "Well, tell me the different departments that you have." And they had one department called Research and Reconciliation. I said, "Well, what does that mean?" They said, "Well, that means that the statement got out with errors and now we are having somebody investigate the error and correct it."

I said, "In factories we call that the Rework and Scrap Department." They said, "Oh, we can't use those words here. We are a professional outfit. This is a financial institution." I said, "The concept is the same." "No, it isn't." "Well," I said, "let's not argue about whether the concept is the same. You are asking me to help you determine how we can have greater output of this department. That's the wrong question. The question is, why is that department there in the first place? Why are you generating so many errors that you have to have 125 people in the Research and Reconciliation Department?"

If we are not careful, and just look at things from a pure productivity point of view, all we will be talking about is how to do the wrong things more efficiently, rather than how to prevent that kind of activity from occurring in the first place.

And by the way, that is going to be a recurring theme with many of us here, that prevention is one of the things we should be thinking about again and again and again.

I was talking to an attorney a couple of days ago who told me he worked for a company in which they were required to review contracts four times. The attorney had to review it, and the secretary had to review it, each four times. They were supposed to check on each other and to initial off at the end of each review.

It seems to me that there is a lot of detection involved there. Sure, they were trying to prevent some disasters later. But the question that you'd really want to ask in a case like that is, is there any method that you can use to prevent that kind of activity?

We also know from a motivational point of view that if you know that others are going to check what you are doing, that you are less likely to do your work with care. In some experiments where we have only one checker we find the outgoing quality is better than if we have two. The second depends on the first and the first on the second. Not always, but this is something for you to think about, to experiment, to see whether you have this kind of activity imbedded in the work that you are doing.

Now, going back to the statement that everyone has two jobs, doing the job you are assigned and then improving on it. That is quite a new concept, because many people would like to say, "I would like to learn how to do my job perfectly, settle into a routine, and just stay at that. Nobody is going to hassle me. I have got other things I would like to think about." Instead, what we are saying to them is, change is a way of life. Every job can be improved. Every one of us has an internal customer whose requirements will change over time. The target we are trying to hit during our career is a moving target. This means that there must be ways to improve what we are doing over time. That is what we are interested in, to get everybody to look at it from that point of view.

Jack Welch, who is chairman of General Electric, puts it this way: "If it ain't broke, fix it." Because if you wait until it is broken, it is too late. So it is not busywork trying to improve on things that are supposedly okay. But we are saying that we can better satisfy others in our agencies or departments. We can better satisfy customers if we take the point of view of never-ending improvement.

And, you see, that is contrary to what we might have said in the past. So one of the things that the quality assurance sciences bring to us is a new way of looking at our managerial and professional responsibilities, rather than the traditional way we might have been taught in the past. It is a new way of thinking.

Now, there are some new tools involved, too, but we are talking about a new way of thinking about our jobs.

Now, let me just get into some aspects of the quality sciences. One of the first things that we sometimes talk about is that in commercial organizations when we use the word "customer" we mean somebody outside the firm. We do market research, and we try to find out how well we are satisfying our customers.

Many years ago Dr. Ishikawa of Japan was talking to a group of people in a steel mill. The people in one department were complaining about the quality of the intermediate product they were getting from another. He talked to the people in the two departments or sections of the production line. He said, "You in the second department who receive the materials from the first should feed back information; tell them what your requirements are. You are the customer of that other department. The way you are running this plant now, you are trying to show a great versatility by making do with whatever you get. And likewise, you in the serving department are simply viewing them as being stuck with whatever quality of products or intermediate that you give them, because they have no option to get it from anyone else. And we should work together as a team and develop normal customer-supplier relationships, meaning trust, respect, and demand for quality levels."

And so he talked about the internal customer and the internal supplier, and trying to get that concept within all departments of an organization. Each of us is viewed as having certain customers and certain suppliers. People who feed you information or reports or decisions or provide other things for you are your internal suppliers. And likewise, you provide requests, you provide assignments, you provide whatever it is you provide. And, so, look at organizations in terms of a series of customer-supplier interrelationships. Each of us here is a customer of someone else's work. And each person here also supplies direction, or requests, or reports, or whatever it is that you do.

We would like everyone in the organization to develop that outlook, no matter where they are in the organization chart, including Secretary Bennett or any other Secretaries of the departments that are represented here. Sometimes they are surprised at how many people there are with whom they deal; how little they know about their requirements (their criteria, using Dr. Greer's terminology), and how well we let them know what we want in measurable terms.

Let me give you an example. I was working with a bank in which one of the tellers did her job without error, did it quickly, but she wasn't a very friendly person. Customers complained about her. Her bosses went up and said, "You are doing a good job, but be friendly." She said, "I am trying to be friendly. My family thinks I am friendly; my neighbors think I am friendly. What does friendly mean?"

So, if we establish criteria we have to have an operational definition. There has got to be some way that the person in the organization knows what we mean. Otherwise, communications and improvements can't occur. And some of the things that we have in mind that we would like other people to do are very difficult to describe. We have to work very carefully with each other until we can finally find out what it is that they have in mind. So, operational definitions are extremely important and sometimes difficult to come by. If we are not careful, we grab those that are easy to measure first, rather than those that are significant.

Let me give you an example. You have probably heard the story about the drunk who was wandering around at night trying to find his lost billfold. He was found searching underneath a lamppost. When he was asked why he was looking for his billfold there, he said, "Well, that's where the light is." It had nothing to do with where he lost his billfold.

That's the way it is sometimes when we develop measures. We develop measures that are easy, but are not the significant measures for those things we are trying to really measure in an organization. And so that is another part of the challenge that we have, and it requires great communication with people with whom we work.

Now, another problem that we have when we look at this customer-supplier relationship is, what are the requirements of these customers, and do they vary over time, and how can we take this into account? Your customer might be the person who receives your report or receives information from you or assignments, whatever. And let's look at some aspects of it.

Let's say that you and I decide to buy a car. We buy this car. We are pleased with it. So we say our requirements are met. But, during the next couple of years all sorts of things fall apart on this car. And now how do we view the quality of this car? Not so good. In some cases we might say, well, there are two different aspects. One is quality when you buy it and the other is quality during use.

Most customers aren't that sophisticated. What they are simply talking about is, are my requirements met during the lifetime when I am using the service or during the period when I am using the service or product? In the case of education, am I happy when I graduate; am I happy five years from now; and, am I happy ten years from now? Do I feel that what has been given me satisfies my requirements, not just at graduation, but during some reasonable length of time afterwards?

Or, if you are writing a policy and procedures manual, or some sort of a brochure that is to be sent out to the public at large or to various schools, and the question is, how perishable are the data? Is it useful now? Will it be useful a year from now, two years from now, or whenever?

Some things, by their very nature, are designed only to have a short life. For others, we have to think about the normal use of the product or service that we provide. We are expected to anticipate those requirements over time; not just initially, but over time. If you are developing reports and a management information system, are you anticipating what kind of reports will be used over the next five years, not simply what might be used in the months or weeks ahead?

And so, quality has this dimension of not just initial satisfaction, but satisfaction over a certain period of time. Technically, professionals in the area of the quality sciences might separate those and give them different names, but I think most people aren't interested in talking about two kinds of quality. They are simply talking about some kind of satisfaction that they get, and that is all they are interested in. Another very interesting comment about quality, or a way of looking at the quality of anything, is to look at it from what is sometimes called a process point of view. That is, any work that has a series of steps can be viewed as a process.

We are not talking about a manufacturing process. We are talking about any kind of process. As an example, a switchboard operator receives a phone call and an inquiry is made to try and get a given service. What are the steps that he or she goes through in order to transfer that call that came in to the right person, and then subsequently, when that person got the call, whether they have to transfer it to someone else or they in fact were the right party?

In an organization with whom I worked recently, 60 percent of the calls had to be transferred to a second person. If you were to walk by the switchboard operator, would that have occurred to you? If you hadn't studied the system, would you have ever known what was going on? The switchboard operator was a very pleasant person. There were no complaints about what the switchboard operator was doing, but when people in the organization dug into what was going on, there was 60 percent rework for that process.

These are the kind of things we would like to improve, even very simple, basic things in an organization. Sometimes when we analyze processes or look at professional or administrative or management work or technical work we do it in terms of a series of steps. We learn a lot about those processes that might escape us had we not done so. So, one of the things that we like to do in quality improvement is to have groups of people within organizations, people who are familiar with the work that goes on in those organizations, to do that sort of analysis, to do flow charting. They try to find out what is really going on in the process versus what people think is going on and what they would like going on.

Sometimes we have an interesting exercise. We would say, describe the steps necessary to initiate a new policy or procedure that we have in an organization. Tell us how it works. We have everybody go through the flow charting. And then we would say, okay, now that each person has done this individually, now let's bring them all together and compare them. People say, "You are wrong, it doesn't work that way, it works this way." Pretty soon we find that there is disagreement within the organization, because we have not studied it carefully, we have not determined the optimum, we have not indicated how we handle exceptions, and two things will happen.

In some cases, we have two groups who feel they have the primary responsibility, in which case we have politics. In other cases, we have no one who feels they have the primary responsibility for a certain part of that operation, in which case we have chaos; things slip through the cracks. Somehow we cover them afterwards, but we don't anticipate them.

So, this is an important way of looking at organizations. If we want to go a bit further in this whole business of process analysis, one of the things we might do is to look at certain activities. We could keep track of complaints and then see if patterns occur. Let me give you an example.

We were working with an architectural and engineering firm in San Francisco who made drawings and specifications. These were sent to the Middle East. About six months later construction would start. There are a number of interesting things that occurred.

One was, engineers who were working on the other side of the wall to the left of me thought, well, our layout can be improved if we just close off the door that is here. We really don't need that door because there are several other doors in this room. In the meantime, the engineers on each of the other walls was making the same decision, and now the blueprint got to the Middle East. Here is a room without doors, and they say, "How could this happen? What is going on in San Francisco?" And so they would start sending nasty letters back, and phone complaints one on one. Pretty soon it got to the point where the blueprints were actually viewed as a suggestion and not as a way to construct anything. Well, that was the ultimate chaos!

Now, what could we have done, and what did we do? Every time they discovered something that went wrong they wrote it up on a little slip and put it in a box. And once a month they cleared this box out and they saw a pattern. Some of the problems occurred quite often, some less often, and so on. A pattern of priorities developed. Now they could go back to the people in San Francisco and say, these are the things that happen most often. It wasn't griping on a one by one basis. Patterns were seen, and changes could be made in training, or procedures, or the way they did things in San Francisco.

And, by the way, if you wish, you could call that a "Pareto" distribution, depending on whether you like the Italian pronunciation or not. And this is simply a ranking of the problems in a priority fashion. Some of you might simply say, why give it a fancy name, you know, the top ten, whatever. Well, I don't really care what name you give to it. Just that you have some sense of priority.

What does that have to do with a flow chart? If we find that there are certain problems that occur much more frequently, we then try to go back into the work process and find out where they started. And that is a start of prevention. You see, we could put an extra inspector on the end to check the drawings in the case I gave. But instead, we could go back and find out where they get their start, what is the cause of that problem; can we remove it once and forever? And, so in many cases we have two options. We have the prevention option or we have the detection option.

Why do employees in an organization prefer the prevention option? Nobody likes to spend a day or a week or an hour doing things in the wrong way and then have somebody come back and say, sorry, you wasted your time. This whole day's effort, this whole week's efforts, or an hour's effort, is all wrong. You don't feel good about yourself. You don't feel good about the people who gave you the assignment, who didn't help you prevent the problem. Prevention is one of the concepts we are interested in. We are interested in the satisfaction that people have in doing work right the first time. That is more than a slogan! There are ways of helping people with the methods of the quality sciences. One of the ways that people in the quality sciences go about it is through drawing these flow charts, trying to find out points in the flow chart where there is a potential for problems, or problems in fact have occurred, and then to find ways of removing the cause of those problems.

Another thing that we would like to do is, when we look at the process, look at all the steps we have in the process, all the checks we have, to make sure that all the things that we do are related to some things that our customer eventually wants and we have no extraneous work. Let me give you an example.

There is the story--perhaps it is apocryphal--of the guard standing next to a bench at the Arch of Triumph. Somebody who was looking at quality improvement asked, "Why do we have a guard there?" The French army, so the story goes, never throws away records. They went back into history and found out that about 100 years ago, or whenever that arch was put up, the bench was painted and a guard was put there to make sure nobody sat down on the bench.

And now, 100 years later, all the relatives and friends and ancestors of that guard are still there. The question for you is, in your own organization, did you have a problem occur that required you to put an extra check on or an extra procedure in, but now you removed the cause of that problem, but the check or procedure is still there? Question: where is that French guard in your agency or department? How can we find that French guard and get rid of him, because he is adding to cost and not to value, and if we have limited resources we would rather use those resources in ways that will add to better quality of service.

In staff service or service organizations, we sometimes have difficulty in developing quality measures. One of the measures that is quite obvious is a measure of timeliness. You want something done in a certain period of time. The question is, do those who work on it get it done in time? And if they do, you say, well, their quality of service is good. If they don't, you are unhappy.

So, in many kinds of professional work, in many service organizations, even in many other kinds of organizations where you are handling materials, such as the Postal Service, timeliness is a very important measure. There are ways that we can go about improving timeliness.

A second measure is a little more deceptive. And that is a measure that we sometimes call first time through. It is not error rate. One of the things you might talk about is how many errors are created in a given department, how much mail is missorted, gets to the wrong place. I am not talking about that. In many cases, we keep doing things over and over again, so many times that it always gets right, but at great cost. And so we think our quality is good. What we are really talking about is how much makes it through the first time without being recycled? That is a first time through measure.

In manufacturing, if 100 television sets come down the line, how many repairs or modifications do we have to make per 100 sets before they get out? In law firms, in accounting firms, in mail departments, with people who are developing policies and procedures, doing all sorts of administrative work, the question is, how many times does it cycle back before the report finally gets out?

That is a first time through measure. It always gets out right, or maybe most of the time, but you see what we miss is the intention of getting it done right the first time. And so I like to use that as my second measure, a measure of first time through. How many cycles does it take to get any work through the first time, to get it out so there are no errors?

Now, the last measure that I sometimes use, and there are a variety of forms. It depends on the application. I sometimes talk about a measure of relevance or satisfaction or style. It all depends on the application. Let me give you several examples. Let's say that you are my friendly mortgage officer, and I go to your bank, and I want to get a loan. You do it quickly. Great for timeliness. No errors; processed quickly. But while I am there, I notice the loan application forms of all of you in the front row of this conference hall on your desk. I can see how much debt you have, what your salary is, and all kinds of personal information about you.

Now, what is the quality of that loan operation? Done quickly. No errors. Am I satisfied? No. Confidentiality has been breached.

Let me give you another example. Let's say you called my office for some information. It is done quickly. No errors. But the secretary is very unfriendly. She is in a hurry to get to lunch, or in a hurry to leave for the day. Or is not having a very good day. It makes you feel that you are part of the problem for asking such a difficult question. But she gets it to you without error and quickly. How do you feel about doing business with me? Are we a quality house? You'd say, "no."

So what I am saying is, there are many dimensions of quality when you are talking about administrative and professional work. It is not just done in a timely fashion, not just done without error. But there might be another measure of overall satisfaction, style, service, confidentiality, depending on the problem we have. And so one of the things that it is important to remember is that an overall measure, even though we would like it, is very difficult to come by, and economists have discovered this years ago.

When the Consumer Price Index was first brought out in the 1920s, economists all over the land complained about all the shortcomings of the Consumer Price Index. Through the years we have learned that the Consumer Price Index, used properly with other indicators, is a very helpful indicator of how the economy is going. And so it is with quality measures. We might find that we would need several quality measures. I have given you a few that would give you an indication of how service in a given department or agency or whatever might be going.

Another way that we sometimes look at the process is in terms of the degree of variability that occurs in that process. Perhaps we have new people coming in, so the results aren't predictable. Quality of the output varies quite a bit. So one of the things that we want to do is to look at things from the point of view of variabilities at various stages, not only inputs to the process, but the variability that we might have at various stages in the output. That is the statistical approach that Dr. Greer talked about: using concepts of statistical process control. I don't want to talk about that any more other than to simply say that this is an important concept that people in the quality assurance and quality sciences use. It is more than the deterministic concept I used earlier. We had different steps in a process and assumed everything moved from step to step without any trouble. Now, the other vision of the world that I introduced is, now that there might be quite a bit of variability of the work coming into a department, or process, variability in the work that goes at each stage for whatever reason. And now, how do we control that variability?

There are a number of ways that we can do that. And for some of you here that might be an important kind of application. If you think you are interested in those things, there are many seminars on statistical process controls that you might attend. Some are offered by the American Society for Quality Control, or other groups, local universities, and so on.

The next concept I would like to talk about is what we might call a systems audit. Now, let's talk about financial audits for a moment, and let's see how the financial part of the world operates. In commercial companies, the way the books are kept is based on a series of generally accepted accounting principles developed by the accounting profession. People who develop reports that are to be used by tax authorities, by bankers, by stockholders, by companies registered with the Securities and Exchange Commission, all must follow these generally accepted accounting principles. From time to time, some opinions are written by the Financial Accounting Standards Board that might indicate how these principles are to be applied in certain areas. Reports for the managers of the firm are not covered by any external body. The way the books are kept for running the business has nothing to do with the way the books are kept for these external to the firm.

So, to reduce complexity, what most companies do, and most organizations do, is try to force that external system into the managerial system and hope that is works. They don't want to develop two separate sets of accounting systems; one for those external, one for those internal.

External auditors are brought in to evaluate whether generally accepted accounting principles are followed if your firm is listed on a stock exchange. If you look at the annual report of a company there are only two things you have to worry about. If there are two paragraphs written by the auditors it means everything is okay. They say we have taken a sample of the transactions of what goes on with the company and we found that they have followed generally accepted accounting principles, so we give you a clean bill of health.

But if there are more than two paragraphs, then they will tell you that they have some reservations, and then they start spelling out what those reservations are. So there is a set of standards as to what a sound accounting system should be.

Now, in the quality area, we have the same kinds of things. Remember in the beginning I said that there were two aspects of a job, one is doing the job right, and then the second is improvement. In many organizations we have a quality assurance system, a set of various policies and procedures, methods, practices, all listed, and that tells you how you are supposed to do the job. It doesn't tell you how you are to improve it. It just says that is the quality assurance system.

From an auditing point of view there are several kinds of audits. One is the systems audit. Another is to look at the methods and procedures by which you measure or check work. And the third is a practices audit, which is to make sure that people are doing what they are supposed to be doing. This is the kind of work that--the latter--that supervisors should be doing. Occasionally, perhaps, somebody internal to your agency might come in and ask people, what are you doing, can you show me where in one of the instruction manuals or policies and procedures it says you are supposed to be doing it in this way?

Sometimes people drift, and they develop new procedures or guidelines that they don't document. That causes all kinds of trouble for organizations.

You find people doing it one way here, another way there, or it is only in the mind of somebody. Somebody says it is okay to make that change but it is never documented, and so we have all kinds of confusion within organizations. One of the things that we recommend is that internal to your organization you have a quality assurance function to do systems audits.

Commercial manufacturing firms occasionally have an external consulting firm come in about every three years, not every year like they do in accounting, but about every three years to come in and do a systems audit of their quality system. To the best of my knowledge, governmental units have never done this. You rely on your internal audit groups within government to do this for yourself, whether within your agency or some overall body within government. The Government Accounting Office is close in its activities.

A systems audit has a couple of parts to it. One is, it tells you whether or not you have a system that is generally agreed upon as a good system by professionals, not only in the U.S., but throughout the world. Professionals are in general agreement on what the elements of a sound quality system are. Frank Caplan, who you know very little about, who introduced the program this morning, has written a very fine book in this area. You might want to look at that some day.

The first important point here is, is the system being followed? The second aspect of it is, do you have a cost effective way of doing it? And that is sometimes difficult for those within an organization to do by themselves, especially if they designed the system. They don't have the necessary objectivity. They might find it difficult to compare what is being done with what might optimally be done had somebody with greater experience or breadth of experience come in and looked at it.

What's the objection to external audits or even internal quality audits? Well, you've got people checking on people who are checking on people who are checking, and it seems to be an endless kind of thing. We are not checking the work here, we are checking the system. We are evaluating the system. We usually are not talking about evaluating the work that is done by a given person.

These are some of the other aspects that are helpful in assuring that the quality is what it should be, and Dr. Godfrey will be talking about some of these things to a much greater extent.

When we look at problem solving in a professional environment, one of the first things we would like you to identify is who your customers are. Who are you internal customers? You might say, well, the people who cause trouble are my external customers. Well, let's forget them for a moment. Let's just take a narrower view and find out those within your particular agency or department who are your internal customers. They get whatever it is you produce, they get decisions, they get reports, get brochures, get funds, whatever it is that you do: even schedules and sometimes deadlines.

We would like to put you at the center of a diagram, which we will call the sun diagram. Draw a circle, put yourself in the middle. That is your job. Now we would like you to draw arrows out from that circle to all the different people who get information, reports, decisions, funds, or whatever it is that you give to them, and draw circles with their functions at the end of those arrows. You now have a sun diagram, and it tells an employee who their internal customers are and those to whom he/she supplies information, reports, whatever it is we supply. Those are the outflows.

At the opposite end of each arrow we look at the inflows to us. First of all, we had the outflows from us. Now each of those people will be feeding something back to us. What might that be? Perhaps feedback on the report. Maybe a report. If I ask somebody to do something, I view them as a supplier. They view me as a customer for studies, for requests, whatever. And so they will evaluate how well I make these requests. Do I make them timely? How do I do it?

And so now we see the interrelationship between ourselves and those to whom we supply information or make requests. They, in turn, give a feedback to us. This is very useful in seeing the relationships that we have within an organization. Of course, the next question we would ask is, well, what are all those outflows and what are all the inflows? And how well are those done in terms of timeliness, first time through, satisfaction? We can make quality measures and we can diagnose organizations in terms of how well this is being done.

Another tool that we sometimes use is called a cause and effect diagram. Now, you know that old story--or perhaps you don't--that was told by Dr. Shewhart many years ago, one of the great founders of the field of quality, about the fellow who drank scotch and water, got drunk, bourbon and water, got drunk, rye and water, got drunk, and stopped drinking the common ingredient, water. Now, of course, what is wrong with that? The solution had nothing to do with the cause! But there are many problems like that in government policy. Kids aren't doing well in school. Build public housing. Build public housing; kids still aren't doing well in school.

Well, in that case one of the problems is that there might be a multiplicity of causes, and in some cases we try to oversimplify problems and pretend there is just one cause and one effect. And so one of the things that people in the quality sciences try to do is sort out problems in terms of those where there is a single or dominant cause versus those in which there are a variety of causes. In some cases the causes even interact with each other, and have a multiplier effect.

We know that effect in medicine, that by itself we can say that asprin is quite good, but asprin for certain kids with certain illnesses at certain age groups can produce deleterious effects. An interaction has occurred. A particular malady, a particular age, and a substance that is ordinarily good reacts in an unforeseen way, and that is what we have to concern ourselves with.

Okay, now, what about standards in education? Dr. Greer talked about criteria. These are extremely important whenever you talk about quality. Standards in terms of tests. Standards in terms of what it is you are trying to deliver. Standards in terms of how you try to administer something. Standards for school boards. Standards for business managers of school systems. Standards at all levels.

Now, for standards to be effective, they must be mutually agreed upon. They shouldn't be coercive. There should be a quick feedback, provided in a way that is not threatening. They should be given in a way that signals that we are trying to help improve the system rather than put someone down. Again, Dr. Greer implied this a bit in terms of how some of the evaluations of some of these criteria work. In many cases people aren't interested in standards, or even interested in small group processes and quality improvement, if they feel that the output will be unfair, even though the process used is fair, so there are two things involved.

One is, is the process by which you make the evaluation fair, and then, is the output fair? I, as an individual, might not want to get involved in establishing criteria or involved in small group activities and improving services, even though I might feel that we use democratic processes. If 80 percent voted in favor of some program, I might find that that democratic process isn't good enough. Majority rule, or 80 percent, or whatever, might result in something that is quite damaging to me, so I don't want to have any part of it. So think about those two parts whenever you are working with criteria and you are working with evaluation.

Even though the process is fair, someone might not like what you are going to do with the output. One of the reasons that we have small group activities, such as quality circles, fail to a great extent in industry is because many employees are worried about whether those two aspects are being handled in a fair way.

What is the potential of the quality sciences in running government and in the educational curriculum? I have been concentrating on a number of suggestions for how these concepts might be used in running your agencies and departments. Let me give you some curriculum suggestions.

The first is, when we talked about customers and satisfying customers, at the kindergarten level or pre-school level we can get children to think about what they like, and to be aware of what their requirements are. And then, next, to get them to be aware of how can people sell what they like? In other words, the marketplace. How do they know what it is that you want? You know what you want, but how do they know it? How does that information get to them? And then as they have part-time jobs in the neighborhood, one of the things we would like to get them to understand is this customer-supplier relationship. How is satisfaction developed in business, government, and in the media? We do that in the high schools. Parts are handled earlier.

Then, the next concept we would like to get them concerned with is teamwork. We are noted in this nation of having a heroes concept and not being much on teamwork. We should be aware at the lowest levels of what to do with others, what kind of things would we like to do with others in pre-school and kindergarten. In the first grade, what can you do to make it easier for others in your classroom when you are involved in play or group activity? At the sixth grade, how can you get your ideas listened to by others? And even teaching concepts of brainstorming and the nominal group process. And then in high school, how to go about complex group problem solving and project work.

We then like to get concepts of measurement introduced, in pre-school and kindergarten, more or less. In the fourth grade, some concepts of graphing, perhaps temperature, cause and effect, puzzles. In the sixth grade, group problem solving, prioritizing, and the concept of standards. We then like to introduce concepts of variability. And in pre-school and kindergarten look at height and time, have kids line up and show them that some are taller than others. The variation of heights. More time, less time. In the fourth grade, concept of seasons and to develop various models or ways to describe things, bring in concepts of models. In the eighth grade, averages, graphing, ranges. The concept that problems have more than one cause. The tenth grade, the concept of interactions between causes.

And then systems concepts, the fifth category. In pre-school and kindergarten, the order in which you put on your clothes; the order in which you put on your shoes and then tie them. You don't tie them before you put them on. In other words, the concept that there is a right sequence to do things. And then, as we get in the fourth grade, things the family has to do to shop, clean, or get people places, looking at the steps in the process, parallel processes that occur in family life.

In the eighth grade, staggered processes, feedback, collective action, some concepts of computers.

Well, I hope I have given you some ideas on how some of these concepts of the quality assurance sciences can be used, not only in the management of your own work in your own departments, but some that might be used in education at various steps along the way.

Thank you very much, ladies and gentlemen.

Mr. Walser:

We appreciate very much your presentation. I think it is now time in the process he was talking about for a little customer feedback. I have a question or two here. I have one that has been delivered to us. There are also microphones in the aisles, as you can see, and those are there for your convenience if you wish to engage in a discussion, a little dialogue, question and answer.

This seminar is being recorded so that we can produce some reports from it, or extract information as would be appropriate from these meetings. So it is now your time to ask Mr. Golomski a question or give him some of your reactions. And here is the first one.

Question: One, given the absence of the bottom line in government, and two, given the requirement of top management support to implement and institutionalize new concepts, and three, given that top government managers know and care little about improving productivity (efficiency, quality, and timeliness), what makes you believe that quality sciences can be effectively applied to government programs?

Mr. Golomski:

That is a superb question. I have run into it as I have worked with various governmental groups, and currently am working with the city of Madison, Wisconsin, and the city of Chicago in some aspects of government, and as you know, Chicago government is as interesting as any theater on Broadway, so it involves the participation of a lot of diverse segments of the community. I approach it on three different levels.

The first is an individual level. I find very few people, and I mean very, very few who really don't care whether they do worthwhile work during the day or not. There are very, very few people who would enjoy working all day long and finding out that what they had done wasn't worthwhile. There is a tremendous amount of pride in people at all levels. I don't care what their family background is, what their educational background is. People like to do work well. I have even found this in working with people in prison, who might not have any hope of ever getting out. They still want to do work well. They don't like the idea that they would spend the whole day or several hours or several minutes doing things that weren't worthwhile.

So, the first level is the individual level. The second level is the intermediate manager level. And again, people at this level find that they are constrained for budgets, that their upward career advancement is based on how well those who report to them do, and if they concentrate on simply ingratiating themselves to people at levels above, they will never make it. They have to have the support of those who work for them, and so the more they can get them involved in quality improvement, the better off they will be. One of the most marvelous reputations that anyone can have is to be a great developer of people, even to the extent that occasionally somebody will pass you up and move onward in the organization. That is still a marvelous reputation to have, because when they have moved up they will recognize what a good job you do in developing people, so that is the second level.

Thirdly, at the uppermost levels in the government, I find that there is more of an interest in productivity in most cases than quality. But in recent years economists have come to realize that through quality improvements you can get productivity improvements. Furthermore, most people are more interested in participating in a quality improvement process than productivity improvement.

And so we find that, even though very few people at uppermost levels are talking about productivity, when we get to talk to them we convert them to also think about quality. They will eventually find the quality improvement program within the organization will result in productivity improvement anyway. Now, in terms of a lot of additional dollars, there are not a lot of additional dollars. There usually are a few front end dollars, but after that programs pay for themselves. I can tell you this in working with all sorts of government organizations. There are the initial front end training dollars, but after that people continue the process by themselves. Have I answered the question, or do you think I am trying to avoid it or throw out a lot of platitudes? Yes?

Dr. Andrew Adams:

I am a little confused by your answer. You have stated that some are interested in productivity and may or may not be interested in quality. I look at these two as the same, not one or the other. In other words, productivity to me is the definition of organizational goals that you want to apply, and if those goals have quality built in, then productivity would be quality automatically; non-productivity would be not making the quality part of our goal.

Mr. Golomski:

Yes, the question is, there seemed to be some confusion in my reply, that quality and productivity are associated with each other and I didn't imply it. They certainly are associated with each other. But what I am saying is that when there are public pronouncements from people at the upper parts of organization, often times they are stated only in productivity language, rather than in the language of quality.

And so one of the things we are trying to do is to get people at upper levels of the organization to understand that quality improvement will lead to productivity improvement. We haven't accomplished in all parts of the industry or government, not only in the U.S. but in other countries of the world. And that is one of the things we hope that people understand.

There are a few cases where a person might have a greater interest in productivity, perhaps in a given piece of equipment that scores tests or something, and the primary interest is productivity, but even there you might get some quality advantages as well. Sometimes you might not.

I was in a hotel recently in which there was one of these forms that is to be scored automatically. There are all sorts of nasty statements on the form, such as, "be careful about the way you fill in these ovals because the machine can't score them correctly." Statements like that that made you feel like, why do I want to fill this out at all? All they are concerned with is productivity of scoring, not my input.

So, some of these things can be viewed from that point of view, but no, I agree with you 100 percent that, yes, quality improvement leads to productivity improvement.

Yes, sir.

Mr. Ullman:

I'm Neil Ullman. I would like to make an observation, kind of comment, and then I have a question. The observation was, your comments about people who don't want to work or who don't really care, and unfortunately there is that conflict with what Dr. Greer was talking about with his child, and unfortunately, that syndrome seems to be prevalent with a lot of young people. At least, I see that in an observational way. I think there are some serious problems, and I don't know how we tackle that issue.

But the question I really would like to touch on is, when you mentioned about the audit, and in the public school sector, particularly on the high school and the college level, you have the accreditation process, and then you have the accreditation process in specific areas. How do you view the audit process that you are talking about in its relation to the accreditation process, and can the two be merged in some sort of fashion so that it might be more productive in accomplishing multi-tasks on that?

Mr. Golomski:

I will answer the second question on the accreditation process, first. I have a little familiarity with schools of business. Some of the best schools of business choose not to be accredited because the standards are too inflexible. And so one of the strange things you have is that the worst schools in the process aren't accredited, nor are the best schools. When you have an accreditation process that just meets at the middle level, then you can stamp out innovation, so that is one of the concerns. Accreditation is good, but make sure that you have some opportunities for innovation.

But the other part that accreditation doesn't get at that you would get in the quality audit, and that is the degree to which a place is administered well, and in terms of the quality systems that are in place for administering an institution of higher education. In my work as part of teams that have gone in to accredit colleges in certain areas, one of the things we never get at is some of these administrative aspects. We concentrate a great deal on curriculum, talk to a few students, a few faculty members, in terms of the degree to which prevention concepts are in place, I don't recall that ever even occurring to us.

Mr. Ullman:

Well, I think you mean in the regional accreditation, like in the middle states area. That, accrediting an institution as opposed to the curricula accreditation, it seems to me that there is a vehicle for modifying that because it does look at the financial aspects and the organization aspects, and it touches all different levels.

Mr. Golomski:

That is a good point, and there is an opportunity to improve that accreditation process. You are right on target.

Yes?

Mr. Scruggs:

I'm Max Scruggs. It seems to me based on my experience in federal government, working in a couple of agencies over the past 20 years, that people are hired to do specific jobs. For example, those jobs may be in the statistical area, the legal area, the education program specialist area. Supervisors, middle managers, and top management get into their positions not by dint of their expertise in management, but because they are available or for political purposes. Our managers are not managers. They have no training, no real training, no substantial training in management, no experience to a great extent in management. Most of our branch chiefs, supervisors, and division directors have only supervisory training. What they care about is doing the work, the statistical work, or the legal work. They don't have any interest or very little interest in improving productivity, quality, or timing.

Mr. Golomski:

That's a good point, and I am glad you brought it up with respect to my response, because one of the things that I find is that when we put people into these positions we can take two points of view. One is that your job as the person in charge is to carry out the transactions of that organization, and what we are saying is, from a quality sciences point of view, that we would like people to view their occupations or professions as having another dimension. That is, transforming the work in the sense of Jack Welch's comment, "if it ain't broke, fix it."

And so one of the things we would like to do is to have everybody look at their responsibilities from two points of view, not just managing, but leading, transforming an organization so it gets better. I find that there is a growing interest in government right now to do that. Whether we are doing it fast enough or in all parts is another thing. I have worked with large manufacturing organizations which have done a superb job. Then I talk to some supplier who tells me, "Look, that's just a lot of smoke. The purchasing agent I deal with is only interested in cost. He doesn't believe in quality."

It is too bad. The message hasn't gotten down to that person or that person's supervisor. And so, to get large, complex organizations to work ideally in all areas is very difficult. When we start the quality improvement process, in most cases, we like to start at the top and then move level by level down through the organization, not to move too fast, until the level above has bought in. That is difficult in many governmental units because people are not in the job too long.

Nonetheless, we do see hope in these areas, and many organizations are trying to do this. In working with the city of Madison, Wisconsin, the mayor turns out to be a very articulate spokesman for quality improvement. He was here in Washington a few weeks ago talking to a national conference of mayors. The police chief was also talking to a national council of police chiefs. That police chief has a quality improvement program in the police department and he is having success.

There are people among the aldermen, I am sure, who might think that this is just some sort of fad, but the people who are running those departments find it is very useful. People within them like the new management style better than they like the old, and so there is a real transformation.

Police departments are among the most difficult because the more contact you have with them the worse your idea of how they operate. If you have never been in contact with the police department, you think they are great. If you get stopped for a traffic violation in the morning, you are a little unhappy with yourself. If you are stopped again at lunch, you think a little about them and yourself. If you are stopped again in the evening you think, "don't they have something better to do with their time?"

So, you see, each of these governmental units has a different set of circumstances to deal with. Police departments have customers, who are the citizens at large and those who are arrested. We have two different segments, each to be handled in a different way. And so I think that's the way it is here. But it is possible. I can tell you, organizations are interested throughout the land and are doing a good job. Whether they are moving fast enough in Department A or B or wherever, eventually we get to the point where people understand, and Congressmen understand.

Recently several of us were in a meeting at which Congressman Ritter spoke. He is an articulate spokesman for this concept. Now, how does he get this to all other folks? I don't know. But there is an interest.

Mr. Walser:

Thank you, Bill. Thank you very much. You will notice in your agenda that this afternoon, after all of the presenters have presented, there is a question and answer panel, where all of the presenters will be here, and you can engage in additional discussions and dialogues for clarification or observation.

Right now it is time for a break. We would like you to be back at 11:30 so we can be prompt in starting the next session. I would encourage you to meet each other. I know there are many people from many different parts of the country as well as different organizations, and take advantage of it and introduce yourself to your neighbors.

Mr. Caplan:

Our next speaker in his current incarnation is the chairman of Juran Institute, a prestigious educational organization founded by Dr. Juran, who has been very active in the quality sciences now for 50 years, I guess. Dr. Godfrey recently achieved that position. We are delighted to have him with us today talking about quality of service and staff in a training environment. Blan.

Presentation: Quality of Service and Staff in a Training Environment

Dr. Godfrey:

INTRODUCTION

I am going to talk about three things today. I want to start with an explanation of why we, those who work in industry, are so interested in the subject of quality and productivity. Then I am going to cover in some detail what we in industry, especially in the education side of industry, are doing. I am going to try to relate this to what I think others in the education business can do. And I will give examples that will be, hopefully, very relevant to some of the work that is going on in federal government, state government, high schools, and even elementary schools.

The reason that industry is so very concerned in quality and productivity is really a national interest. Let me start with a quote from the New York Times from February 7th, 1988: "America can't compete. That perception has slowly and painfully crept up on us in recent years. Many Americans hoped that the falling dollar would solve our problems by making American goods cheaper and therefore more salable abroad. But recent trade figures make it clear that the cheaper dollar is by no means a panacea."

This article in the New York Times by Daniel Sharp was a summary of the report of the 74th American Assembly, held November 19th through 22nd, 1987. The America Assembly was started by Dwight D. Eisenhower while president of Colombia University. He started the Assembly to address a major issue every year. One year, for example, it was apartheid. One year it was nuclear disarmament; last year the subject was global competitiveness. The title of the report from the American Assembly is, "Running Out of Time: Reversing America's Declining Competitiveness." For three days during this conference, 65 leaders from business, labor, the media, academia, and government discussed some of the major issues concerning the ability of the United States to compete in the global marketplace. The first speaker was Richard Lamm, former Governor of Colorado. Let me quote from the American Assembly report.

> "Once leaders in the world, American companies have lost command of markets to international competitors. Though macro-economic factors like exchange rate and trade policies have harmed our ability to compete, a strong case was made that these problems are chiefly the result of ineffective management practices as well as the cause of other problems.
>
> "There are businesses and markets in which U.S. companies no longer compete at all. Those who try to compete find that working harder is not enough, that fundamental changes are necessary."

Let me talk just a minute about what is the problem. As everybody in this room knows, we had record trade deficits, $170 billion in 1987. We get excited when it is down to only $10 billion a month, as it was last month. In product after product, we no longer compete; we don't even try. In many other products we have lost much of our former world market share, even industries we created are now dominated or being taken over.

In the U.S. today there is no longer much debate on the problem, but there is still strong debate on the cause, and very much debate on the solution. There are many possible solutions. In the United States today we are trying most of them.

The first is, we can devalue the dollar. We can, in effect, make each American worker work for half of what he or she was working for a few years ago. Cheap American labor should make our products and services more attractive to foreigners. But according to the International Herald Tribune you can now buy two Buicks in Belgium for the price of a single BMW, but the Belgians still prefer the BMW.

With the recent devaluations of the dollar, American workers now earn only 83 percent of the average Japanese wages, and 6 percent less than West Germans. Workers in seven European countries now earn more than U.S. workers. Even before the recent dollar devaluations, companies like Sony were coming into the United States because of low-priced labor. In the Sony California television plant, American workers were earning 15 percent below their Japanese counterparts and winning Sony's awards for the best quality televisions made in the world.

Another solution is to sell some of the wealth we have stacked up in more prosperous times. We are a very wealthy nation. We have enormous resources in land, personal property, and raw materials, even junk. Two of our most profitable exports--I think they now rank Number Two and Three--are scrap metal and recycled paper. We are selling art works. One Van Gogh recently brought almost $40 million. We are selling our land. Forty-seven percent of downtown Los Angeles is now owned by foreigners. Buildings and land in Manhatten are bringing record prices paid for by people in other countries with strong currencies and huge trade surpluses.

Time magazine had an interesting article the week of April 3rd. In the last two years the Japanese have purchased $3 billion worth of Hawaii, more than the total foreign investment in Hawaii in 20 years.

Another solution is to sell parts of our future. We can sell American-owned companies and business. We are doing this in record numbers. For the first time in history foreigners are investing more in America than Americans are investing abroad. Every day we read that a familiar American brand name is being sold off to raise cash. Bloomingdale's is now a Canadian company. RCA Consumer Electronics is now French. Quasar and Firestone are Japanese. Westinghouse light bulbs are now Dutch. Many major appliances are now Swedish.

Investment houses, banks, and service industries are being gobbled up by bargain hunters from all over the world. In the first four months of 1988, British companies alone bought 124 American companies.

Another solution is to borrow. We can borrow money from all over the world to pay for our trade imbalance and our huge government deficit. We are now the largest debtor nation in the world. Only a few short years ago we were the largest creditor in nation in the world. Japan is now the largest creditor nation in the world, with many of its credits in U.S. securities and bonds. The *Wall Street Journal*, on February 29th, 1988, had a very strong opinion. The title of the article was "Reagan's Legacy: America for Sale."

> "Steady rise of foreign investment in U.S. businesses and real estate may turn out to be the most controversial legacy of Reagonomics. Already the selling of America has become a hot topic among politicians and the press and the sale has barely begun. The economic policies of the last seven years ensure that the foreign appetite for American investment will continue to grow in the coming decade. The end result will be a dramatic reversal of the U.S. role in the world economy.
>
> "For more than 30 years after World War Two U.S. multinationals spread their capital around the globe. Now the nation finds itself on the receiving end. The American challenge to the world as Jean Jacques Servan-Schreiber described it two decades ago has become the world's challenge to America. Even the most optimistic economic analysts see U.S. trade deficits continuing for at least the next decade. Data Resources of Lexington, Massachusetts, projects trade deficits to the end of the century.
>
> "That means foreigners will continue to have surplus dollars to invest in America. The trend startles many Americans who grew up in a

> nation that dominated global investment flows. Throughout the 1950s and 1960s giant U.S. multinationals invested $4 or $5 abroad for every $1 that foreigners invested here."

There is another solution. We can revamp our industrial base. We can once again become the world's leading developer and manufacturer of products. We can once again produce more than we consume. We can once again export the highest quality products in the world and the lowest cost products in the world.

This last option I would like to explore. I would like to talk about what companies are doing. The other options are already being tried by our friends here in Washington, by the most poorly managed companies in America, and by many Americans who have given up, by Americans who feel that we no longer can compete.

So, what can be done? I would like to quote again from "Running Out of Time," the American Assembly report, about fundamental changes the American Assembly thinks are necessary.

> "An increasing number of American firms are now bringing back home the lessons of industrial masters such as W. Edwards Deming and Joseph M. Juran, who taught Japanese industry long ago when U.S. companies would not listen. Those lessons are deceptively simple. After hearing from experts for three days, we have collected some basic principles of what makes a firm competitive, the first of which is quality, an emphasis on making the product or service right the first time.
>
> "Together these principles are: Quality. This does not mean quality merely to specifications, but quality that improves constantly, quality that is characterized by constant innovations that create a loyal customer. It means achieving this attitude from top to bottom, from the boardroom to the factory floor.
>
> "Low Cost. This is not instead of quality but the result of quality. It may seem cheaper to shove as many products or services out as fast as possible, but if quality is ignored the cost in rework, scrap, supervision, and most of all, disappointed customers will be more expensive than any business can bear.
>
> "The Customer. It has to be customer-driven. The customer is part of the process. The business exists not merely to satisfy the customer's need today, but to anticipate their needs of tomorrow.

> "Employee Involvement. The successful business no longer sees employees as a cost of production, but as a resource for production. Although job uncertainty will never be eliminated, it must be recognized that long-term commitment of and to workers is at least, if not more, important that machinery or technology. Employee involvement in efforts to improve productivity and quality is vital, and they must also be able to share in the gains.
>
> "Continuous Improvement. This means never being satisfied, not only with the products and services, but with the way the organization is required in all of these activities. It means changing our attitude from America's traditional 'if it ain't broke, don't fix it' to 'if it ain't perfect, don't leave it.' There are a number of American firms taking leadership and implementing these innovations, and there is a critical need to accelerate this process."

Company after company in the United States, and those companies wishing, desperately wanting, to survive are reacting the same way. They are creating massive training programs to reeducate their engineers, their work force, their managers. They are training these people for the jobs they must do. IBM has created a "university" for corporate technical education with three major parts: Systems and Software Education, Engineering and Manufacturing Education, and Quality.

Bell Laboratories and AT&T have created an entire curriculum: project management for all managers, quality and productivity management, quality planning, reliability prediction, reliability estimation, experimental design, robust product and process design, and quality and productivity improvement. They have an even more extensive software engineering program.

No one in industry today doubts that education is absolutely the essential key for our survival. What I am going to give you in the rest of the talk is some examples of what companies have done and what we think is working. We are applying the same quality principles that we are using for our products and processes to our education processes.

Just a little background on my own education experience. I started teaching as a government employee, a member of the United States Army. In the Federal Republic of Germany on my first assignment I taught courses ranging from everything from driver's ed to nuclear weapons assembly. Later, I headed a special task force working out of the Pentagon teaching inventory control in the Republic of Vietnam to American soldiers, Thai soldiers, and Korean soldiers. As you know, we were pumping billions and billions of dollars worth of materials into Vietnam. Most of these supplies simply disappeared. We had no idea where they were in the inventory or how to get them out.

Then, when I went to graduate school, I couldn't survive just on the GI Bill, so I became a teaching assistant and taught business statistics to sophomores and juniors in the business school as I got my Ph.D. in statistics. Later, I went to Bell Labs and thought my teaching career was over. But after many years of working in research on quality theory and technology, working on network performance and other things, we were asked by a top executive what the status of training in quality control and reliability was for our engineers. We had to answer honestly, we didn't know, but we'd find out.

We did a survey, 1,000 questionnaires to Bell Labs management and engineers; 746 people returned their surveys. Over 70 percent said that a knowledge of quality control and reliability was critical to the success of their job, and over 70 percent of those people said they were very poorly trained to do it. These courses were not covered in the universities, and in these areas they had very little idea of what they were doing.

We couldn't go back with that answer. The answer we had to go back with was what we were going to do about it, and we started our first course. What has happened in the five years since is the list of courses mentioned previously. Bell Labs is trying to reeducate engineers hired from the best schools and universities--the number one school Bell Labs hires from is MIT; the second is Stanford, and so forth. These are the people taking these courses. They could not compete in their knowledge of quality control or engineering for design and manufacturing with the people from across the oceans, especially in Japan.

HISTORY OF QUALITY

I want to spend just a few minutes on my view of the history of quality. The example I like best from inspection comes from Czarist Russia and the fabulous Faberge eggs. (See Exhibit A) Most of us think of Faberge as an individual creating the beautiful jewels that ended up in museums around the world. There were actually 200 people working for Faberge, apprentices and masters and so forth, and they'd present a jewel to Faberge, he would inspect it very, very carefully with a magnifying glass, and if it met his demanding standards, he would put his name on the bottom and present it to the Czar or Czarina. If it didn't meet his exacting standards, he smashed it with a hammer and gave the jewels back to the craftsperson to try again. This is the ultimate quality by inspection, and I think drives home the point on why quality by inspection, although effective--at least he didn't get his head cut off for producing bad quality for the Czar--is efficient. It is sort, scrap, and rework.

Back in the 1920s we like to think that the Americans invented quality control, Walter Shewhart at Bell Labs even coined the terms quality control and quality assurance. There are many earlier examples. The one we use as the logo of our company points out the elements of quality control very simply. (See Exhibit B)

Our logo shows a worker on an Egyptian pyramid cutting a block. Another worker is measuring and giving instant feedback to the worker. The worker can adjust as he cuts the block, not after he has made it and has to throw it away or to cut it to a smaller block to use somewhere else. The instant feedback enables him to control the quality of his work as he does it. It is a basic principle of quality management.

When we think about quality improvement, and continuous quality improvement, we think back to a chart that Dr. Juran made in 1976 where he shocked many people in the western world. He plotted the rate of improvement in Japan and the rate of improvement in the United States, and he predicted that Japan was on its way to quality leadership. (See Exhibit C) The reason why so many people were shocked in 1976 was that most people still remembered "Made in Japan" meant junk. They remembered that toys given to you on Christmas Day that said "Made in Japan" didn't make it though Christmas Day. They remembered the stories even told by Japanese. Japanese businessmen used to say that the first thing they bought when they came to the United States was a ball point pen because ball point pens were too difficult for the Japanese to make. They only made two types, those that didn't write and those that leaked. They said you could always spot Japanese executives by the black badge on their shirt pockets.

What Dr. Juran was noticing was that the Japanese were improving at a rate far faster than anything he had seen. If the Japanese were improving faster than the West, sooner or later the Japanese would pass the West, no matter how far behind they had started.

When we look at this chart today, we can say it doesn't really matter whether it is West or East or Company A versus Company B. (See Exhibit D) If one company has a quality lead, say Company A, and is improving at a steady rate, but the other company, Company B, is improving at a very fast rate, sooner or later in time Company B will pass Company A. And if Company A doesn't react, Company B will widen the gap over time. In most industrial products it is about two years before the customers really understand who the leader is, and then there is a massive change in the buying patterns. Then, not only does Company A catch up, Company A must regain the lead and get the customers back on its side. Nowhere is that more clearly evident than the U.S. automotive industry, where the auto industry has bounced back. They are doing many things. As one professor from the University of Michigan said recently, and I think it's a very accurate and apt quote, "America's auto industry is now making some of its best cars equal to the worst Japanese car, and that is a major accomplishment." Th[illegible] is a very accurate statement. That *is* a major accomplishment.

So, when we started examining what the Japanese did to improve quality we found several things. Upper management took a very strong leadership role. They provided training for every member of the company far beyond what we have ever thought about. They created a revolutionary rate of improvement.

So, what I'd like to look at is what are these breaks with tradition. First, let's look at hands-on leadership. Not upper management in charge delegating, but doing things. Massive training for the work force. Annual improvement goals for quality. The rest of today will focus on this training. Let me give you one example that knocked my socks off. This was a cover story in the New York Times in 1977. The Japanese have a Statistics Day every year. It is a national day, and they have a contest every year. In 1977 the contest was for the best new statistical graphic. They had 29,940 entries for the best way to display something graphically. The winners were five seven-year-old Japanese students, five young girls who had done a study on what makes children happy. They had interviewed their classmates, and they had asked questions such as, would you rate yourself very happy, average happy, or not so happy. Happiness was the dependent variable. Then they studied many other variables such as how much time mother spent with each child, whether mother read to each child each day, how much contact the child had with mother and father.

They identified the key variable, which turned out to be the time mother spent with each child. This was further dependent on the numbers of brothers and sisters, the number of times read to, and other related variables.

Then they created three pictures of Japanese dolls. One happy, one not so happy, and one sad. They printed numerical values on these dolls, so in this beautiful graphic of three pretty Japanese dolls you could not only see which one was happy but exactly why. The results of a study planned, designed, conducted, and analyzed by five seven-year-olds were clearly displayed in these innovative graphs.

When we look at the key processes of quality of education, they are very similar to other key quality processes. You have to know who your customers are, what they want, and what they need. You have to develop and deliver this education, this training. You have to measure the quality. You have to provide self-control so people can take corrective actions and continuously improve. It is no different from when we talk to companies who design automobiles, electronics, or banking services.

When we look at it, it is easy to summarize. (See Exhibit E) There is planning, the up-front work you do to know who the customers are, what they need, and what they have done. The next step is quality control, getting rid of the glitches, the fires, the things that go wrong, and enabling people to fix these.

Then, the third area is quality improvement. Quality improvement is changing the level from wherever you are now to a new level that is far better than you ever dreamed.

QUALITY PLANNING

But let's start with quality planning. First, identify the customer.

I was asked to be the discussant last year at a special session in a conference in San Francisco on the teaching of statistics in business schools. The session organizers and presenters were four professors who had done remarkable things on trying to improve the teaching in large classes, 200 to 500 people in the class. These are required courses, usually at the freshman, sophomore, or junior level. These professors have been working for about five years on changing the structure and teaching methods.

What they had done was truly remarkable. But when I listened carefully, one thing was missing. They had no idea whom it was they were teaching or who their customers were. When I asked the question, we got into a very lively debate. Are the customers the people who hire the business students at the bachelor's level? Are the customers the graduate schools, MBA schools that admit business students? Or other graduate schools, law or medicine, that some of the students are going to? Are the customers the students themselves?

When we went through this interesting discussion of whom they are really teaching and whom they should be concerned about, it became very clear that we hadn't done the next step very well at all. This step is determining the needs. What do students really want? What do the employers really want? Has anyone from the university actually gone and talked to the employers who hired students five years ago to see how well the students are doing with the preparation given them? Or do they have to retrain them?

One of the exercises I go through in my class at Colombia University is the construction of a fishbone chart, a cause and effect diagram.

We talk about what is the goal of the course. The students express it in their own way. The goal of the course, according to the students, is to maximize learning. That is what they are there for. They identify the different branches of the fishbone, the causes that drive the effect of maximum learning. They identify a large number of causes, but when we summarize and get rid of the redundancies, there are really six major areas: the teacher, the syllabus (what is going to be taught), the materials, the assignments, the facilities, and the students.

Then the students break down these details. The first is what they want in the teacher. They are concerned about the quality of the lectures, whether they are interesting, whether they are relevant, and whether they are well prepared. They want the teacher to have relevant experience. They want the homework assignments to be relevant to the course. They want lectures and assignments related to the text. They go through great detail on what they expect from the teacher.

On the materials, of course, they are interested first in the quality of the text. They are interested in the handouts and the visuals used in class.

The syllabus they think is very important. Is it relevant to their needs? Is it relevant to other courses they are taking? Is it relevant to their degree? Is it relevant to the work they will do when they leave school?

About half my students, since it is a night course, are getting their masters while they are working. They want to know if they can use tomorrow what they learn today.

They also want the material to be new. They don't want it to be repetitive of things they already know. And they want it to be challenging. They don't want to be bored.

And so they go through this in great detail, and then we start translating these needs into something I can work with. They translate these needs into what they think is important. They put the heaviest weight, in average 45 percent, on the teacher, on the presentation of the material.

They put heavy weight, 30 percent, on what is taught, on the course, and the content. Third, and way down the list, down around 10 and 15 percent, are the materials. Of course, the one that I weigh higher than the students is the students. I think the students in the class, their participation, their preparation, whether they do the homework and whether they have read the materials is extremely important to the success of the class. They tend not to see that one as clearly as I do.

The one they put very little weight on is the facilities: the classroom, the lighting, the air conditioning, the heating, the computing center, and their own study environment. It turns out they will put up with anything if the course content, the teacher, and the materials are good.

But the facilities are where we put so much money in education. And we put so little in the content of the courses and the quality of the teachers.

After we translate these needs we develop a measurement system, how the students are going to measure the quality, how they are going to provide feedback, what the quantitative measurements are, and how they can use them. So, basically, I am teaching a course on quality control, and I am using the methods that we are going to learn in the class to start doing something that is very important to them. The basic questions are simple. What do you expect? What do you think you are going to get out of this class? Are you going to have fun? Are you going to learn something? How is it going to relate to what you actually do?

And so this class on quality control becomes real to them. This assignment is gone over in class as a group and then assigned to them in small groups of two or three. This assignment is always the best done of any assignment in the whole semester. The students work hard at this. Some of them turn in ten and fifteen typed pages, when the requirement is only two or three. They turn in detailed charts, figures, measurement plans, and how they will take the surveys. They really get into it. The quality of education is important to the university students. It is important to all students.

Let me give you an example on how this quality planning applies in industry, because there is a very good example of these first four steps. The Ford Motor Company years ago decided they had a problem. As they explain it, in 1979, 1980, and 1981 they lost $1 billion a year. They had a major management meeting and decided they couldn't keep doing that forever. They started something that is now called Team Taurus.

And they started looking at very good cars. They did something very strange. They bought some competitors' products, and they actually measured them in the labs and on the test track.

Now, the reason I say this is strange is that in 1980 when Ford first started their quality program they came to Bell Labs where I was working and they were reviewing our quality system. We never laughed so hard at a group of visitors in all our lives. We waited until they left, but they were bad. When we went to lunch, they all wanted to ride with a colleague of mine because he had a Saab and none of them had ever ridden in a Saab. He let one of them drive it on the way back, and they almost didn't come back to the meeting because they couldn't believe the acceleration this four-cylinder engine could give. They couldn't believe the way this little car handled.

Now, this is a car made by an aircraft company in Sweden noted for its technology, and none of these people had ridden in it. These executives were such high level they were chauffeur-driven in Lincolns to Ford every day. They didn't even ride in the cars that produced 98 percent of their profits. The chauffeurs took care of the cars during work, did all the maintenance, and if the car were really broken they had another car for them, so they never even knew if the cars worked or not. They were completely isolated from their own products, completely isolated from the competitors.

That is why I find what they have done so remarkable. They took these competitive cars and they identified 428 quality dimensions. It is not easy. There are very many dimensions of quality for any product or service. Some measurements they could do on the test track: acceleration from zero to 60, miles per gallon, braking, skid pad resistance.

Other measurements are more subjective. They brought in teams of customers. They selected the "best-in-class" ignition switch, customers think it is Toyota; best jack, customers think it is BMW; best jack storage, customers think it is BMW; best luxury door hand, they think it is Mercedes-Benz.

They ranked these. They listed the winners in a book, and then they put a designer's name by each one and said, "beat it or copy it." And they gave a time deadline to the designer. They said, "Oh, by the way, we trust you, we love you, you have been working for us for a long time, but when you have your new design, bring it back, and we are going to bring the customers back and let them pick the winner. If it is not yours, you will have to get a license contract from other people." But 80 percent of the time they thought they either beat the "best-in-class" or equalled it.

As you probably know, in 1986 Ford made more money than General Motors for the first time since 1924. Last year they were almost embarrassed by the $4.7 billion they made. They have gone into quality. It seems to be paying off.

We have used many of the same methods in developing a product and developing product features in the development of courses at Bell Laboratories. The project management methods we use for developing a course are the same project management methods we use for developing a product. We go through careful specification reviews. We go through reviews with potential customers, people who will be taking the course. We look at people who have taken similar things. We visit at least four or five other companies or universities who are teaching similar things. We characterize what they are doing. We bring in customers at periodic intervals--for example, ten people from manufacturing plants visited once a month to review the one course we were developing. We develop these product features very carefully with the customers step by step. And then we develop the process, the process on how we are going to teach the course.

At the Juran Institute where we make our living teaching courses we have a very long qualifications plan for every new instructor. Even though we hire senior people from companies who have been in this business for a long time, they go through at least a year of qualification. They're trained on certain parts of a course. Then they work with the key instructor. They go through about four or five courses with the key instructor, and then they are allowed to present the first one hour of the course, then two hours, then up to half a day, and then up to a day, always getting feedback from the key instructor, always getting feedback from the students. We always have a feedback sheet at the end of every course.

Feedback from the students is one way of improving the process. But the students only know whether what they have been presented is good. They don't know what they haven't been presented. The things that are missing, the things that the students need that weren't even covered, cannot be rated by the students. So you have got to bring the people in from the outside. You have to also use some experts in the field to review the course.

The next step is to transfer the process. How can we get the process that we have created, the course that we have created, into the hands of large numbers of instructors? The qualification procedure is one way. Standardization is another. We can create text materials, workbooks and visuals, but we find out that people don't use other people's examples very well. So we now have a training package to train instructors on how to create their own examples from their own experience and the experience of their companies so they can make examples come alive.

A question came up earlier, does this work in the government? Can we really do these things? Our work on quality planning has been going through about a three-year cycle. We are actually videotaping our course this week and it will be available sometime in September. One of the best examples comes from the Bureau of Labor Statistics. One of the pilot sessions was in improving the accuracy of the Current Price Index.

Dr. Janet Norwood, the Commissioner of the Bureau of Labor Statistics, is very much leading their quality improvement effort. They have excellent leadership at the top. She is doing many things personally. It really does work in the government. There are more and more good examples. The government of the state of Wisconsin and the Madison, Wisconsin mayor's office have done some remarkable things. The Bureau of Labor Statistics and the Internal Revenue Service have done excellent work in quality improvement. The IRS, led by Mr. Larry Gibbs, the Commissioner, has reduced data entry by billions of keystrokes a year.

QUALITY CONTROL

I will just very briefly mention quality control. You have to have some way for people to know what quality is. Individuals have to have a clear definition of what quality is, what is expected of them, and a sensor, a way to measure what they are delivering. Individuals must have a way to analyze this and compare it to the standard. They must have a way to either correct the problem or to go back and improve the product and the process.

If you get this down to the individual level, to the teacher, the administrator, the person running the program, then all sorts of wonderful things happen.

QUALITY IMPROVEMENT

So now if we look at quality improvement, the last part of the trilogy, we just see a very simple sequence. You have to know you need to change. You have to identify the top priorities. You have to have some organization to guide the projects and somebody to actually do the work. The guiders are usually managers, and the workers are usually the managers and the work force members.

You have to have a breakthrough in knowledge. You have to understand something you didn't before. You have to have a breakthrough in results. You have to have the breakthrough in cultural resistance, and then you have to be able to control at the new level.

In thinking about this waste we are trying to eliminate, we see there are two major wastes. One is the waste of the students, teaching the wrong thing. I tried to address that with the examples on planning. That is the key waste. There is nothing worse than teaching them something they don't need.

Not long ago IBM did a study of 5,000 engineers. Two had used differential equations in the first two years of employment. All had designed and run an experiment. All had been trained in differential equations. None had been trained in experimental design.

The other waste is teaching things wrong. And that is the efficiency issue. That is not using available material. That is re-inventing wheels. That is not taking advantage of new techniques: video, computers, physical models, simulation, other aids. It is failure to integrate things being taught, for example, having what the mathematics people are learning tied to the physics they are learning, tied to the chemistry they are learning. Instead, these things are often taught in different years, much less in different classrooms.

There are other wastes. Failures to realize related needs of students. For example, teaching physics students German by reading biology papers. Now, the ultimate counter example of that, I think, has happened this summer at MIT where they have a special course in teaching technical Japanese to computer scientists and electrical engineers. People who already speak fluent Japanese and have an eighth grade knowledge of Japanese are coming in on an NSF sponsored course to learn to read Japanese reports in Japanese. These reports are just in computer science, just in electrical engineering. America is trying to catch up in these two very vital fields.

Another waste is using unrelated examples. Ernst Rothkopf of Colombia University and Bell Laboratories did an experiment at Texas A&M. They ran one course with 60 students, teaching statistics with the traditional examples, with cards and dice. They ran another course where they used manufacturing examples, where they related the problems to more engineering type things. And then they went back and tested these students six months later. The ones who had learned on cards and dice were very able to solve card and dice problems six months later, had never applied what they had learned to their work and couldn't apply it on the simple test questions. On the other hand, those who had learned statistics in a more manufacturing engineering way had used it in their work, were able to apply it to those things, but couldn't solve the card and dice problems. People remember the examples and they tie the theory very carefully to the example.

Another way we fail with students is by failing to support their applications. We let students go off half-learning things, try something and fail and never try again.

And, of course, there are other wastes--wasting the teacher's time, teaching the wrong student. In one of my classes in Vietnam in inventory control we looked up and saw everybody had an MP armband. Eighteen students, all MPs. We didn't believe they had that many people in supply. We asked. They said, well, everybody else is out fighting. The post commander said we had to have 18 people for the class, and we are the only 18 available.

Using poor materials, making do, redevelopment and reinvention are all wastes. When we prepared one course at Bell Labs, we had 800 hours of preparation time for every hour of course time. This included developing the software, developing the course, improving the course. When I think of the time that I and my co-authors spent on our book, it is 200 hours of preparation time for every classroom hour. There is phenomenal preparation time to do things right. You can't keep doing that over and over, instructor after instructor. You have got to take the best, coordinate it, use it so that everyone can use the best methods from the best teachers, and incorporate them in their classes, and make good stuff widely available.

And, of course, appraisal is all waste. All tests and examinations are a waste. If the students knew everything and we knew they knew everything, we wouldn't have to do any testing. And rework is waste. Every time we have to reteach because the students didn't understand, because one student didn't understand or because a group of students didn't understand is waste.

Preparing materials for class the second or third time when nothing has changed is waste. Explaining assignments that should have been done right because the student didn't understand the assignment is waste. Teaching material that students should have learned somewhere else is waste. Most of the teaching we do in industry is waste. It should have been done in the university. It should have been done in the high schools.

When we are teaching factory workers basic problem-solving, it is waste. We are doing it because we have to survive, not because that is what we should be doing. Dave Kerns, chairman of Xerox, says the Achilles heel of America's ability to compete is the quality of education American students get in high school. When he said that, I challenged him afterwards. We had a little bit of an argument. I think the engineering training is even worse, and that that is the Number One problem, but I don't disagree with him that the high school education is almost worthless.

The American Assembly closed their report with a very strong statement: "Education is the Number One priority in restoring America's competitiveness."

Thanks.

Mr. Caplan:

Thank you very much, Blan.

We are right up to the time to break for lunch. If there is one urgent question I will accept it. If not, you can wait until the panel and get your questions in of Blan.

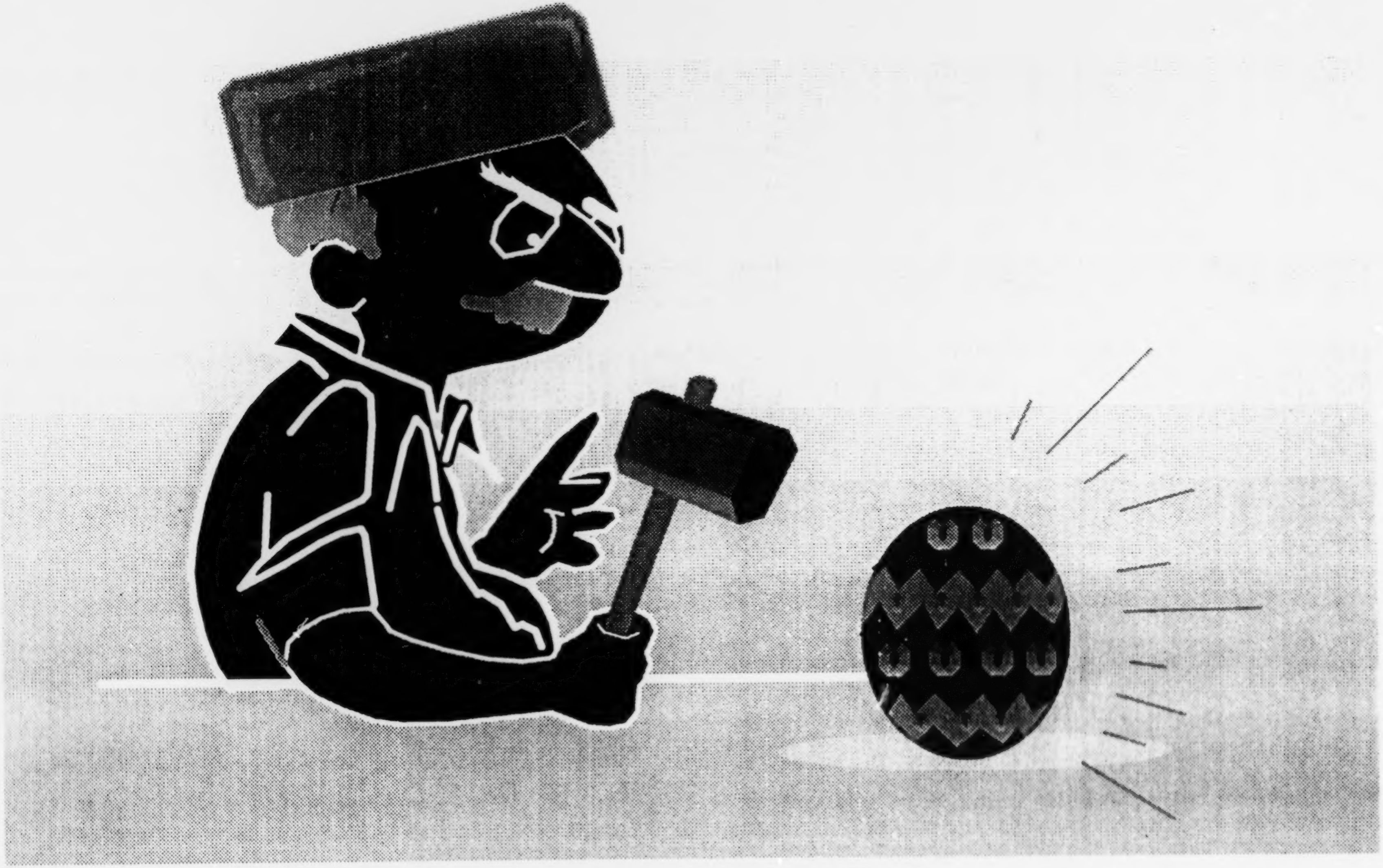
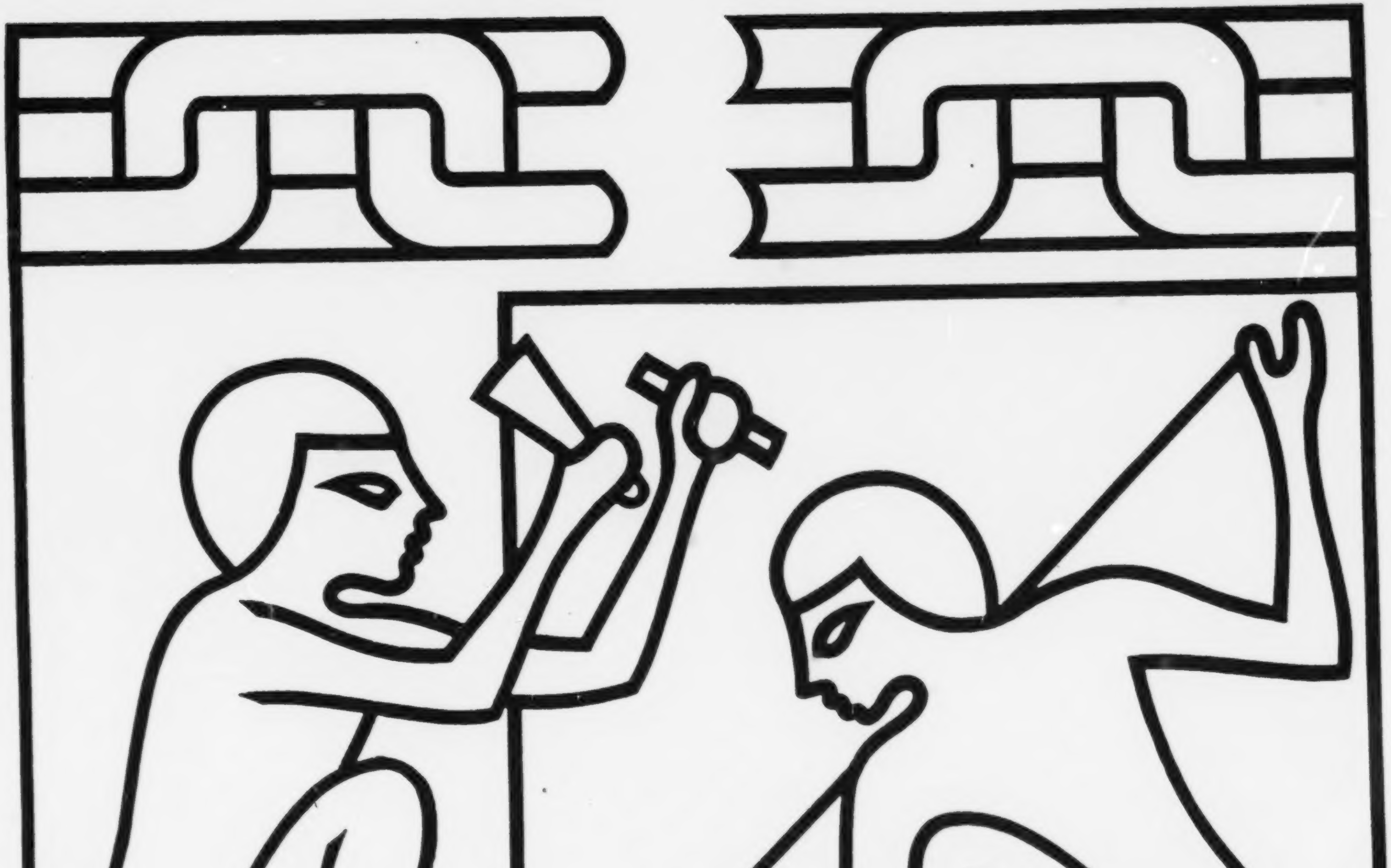


Exhibit A

Exhibit B



WORLD COMPETITION IN QUALITY

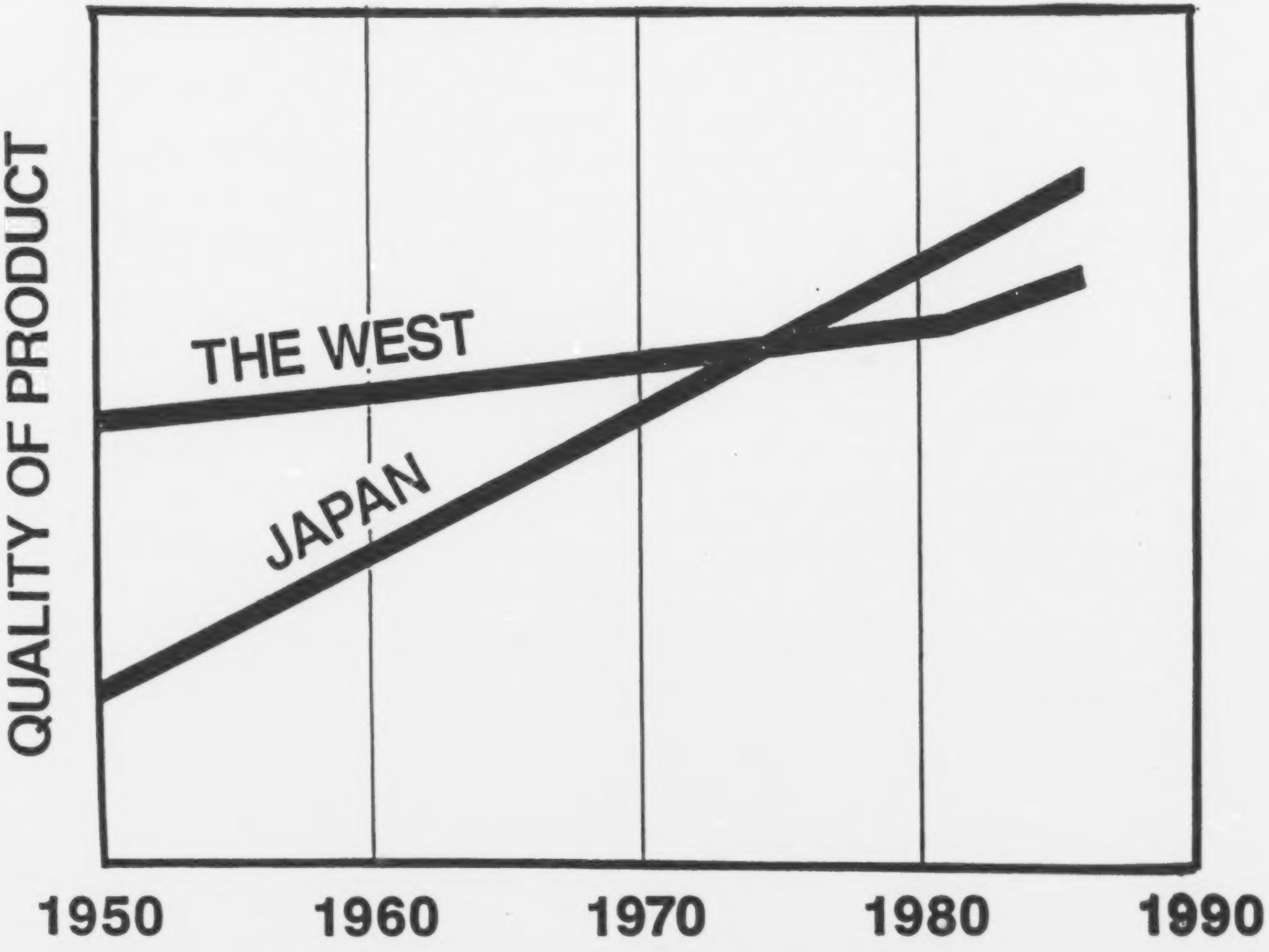
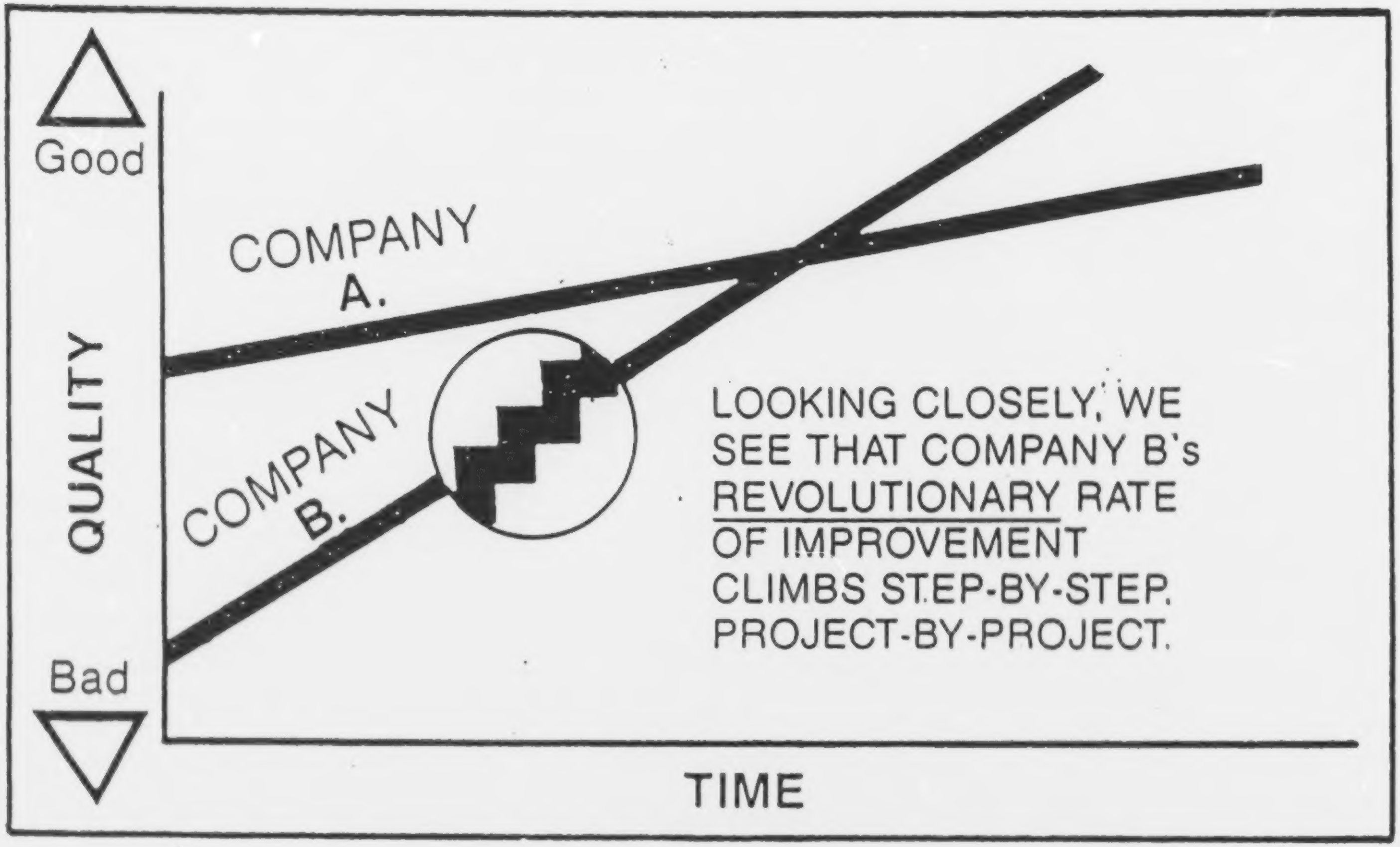


Exhibit C



LOOKING CLOSELY, WE SEE THAT COMPANY B's REVOLUTIONARY RATE OF IMPROVEMENT CLIMBS STEP-BY-STEP, PROJECT-BY-PROJECT.

Exhibit D

THE JURAN TRILOGY

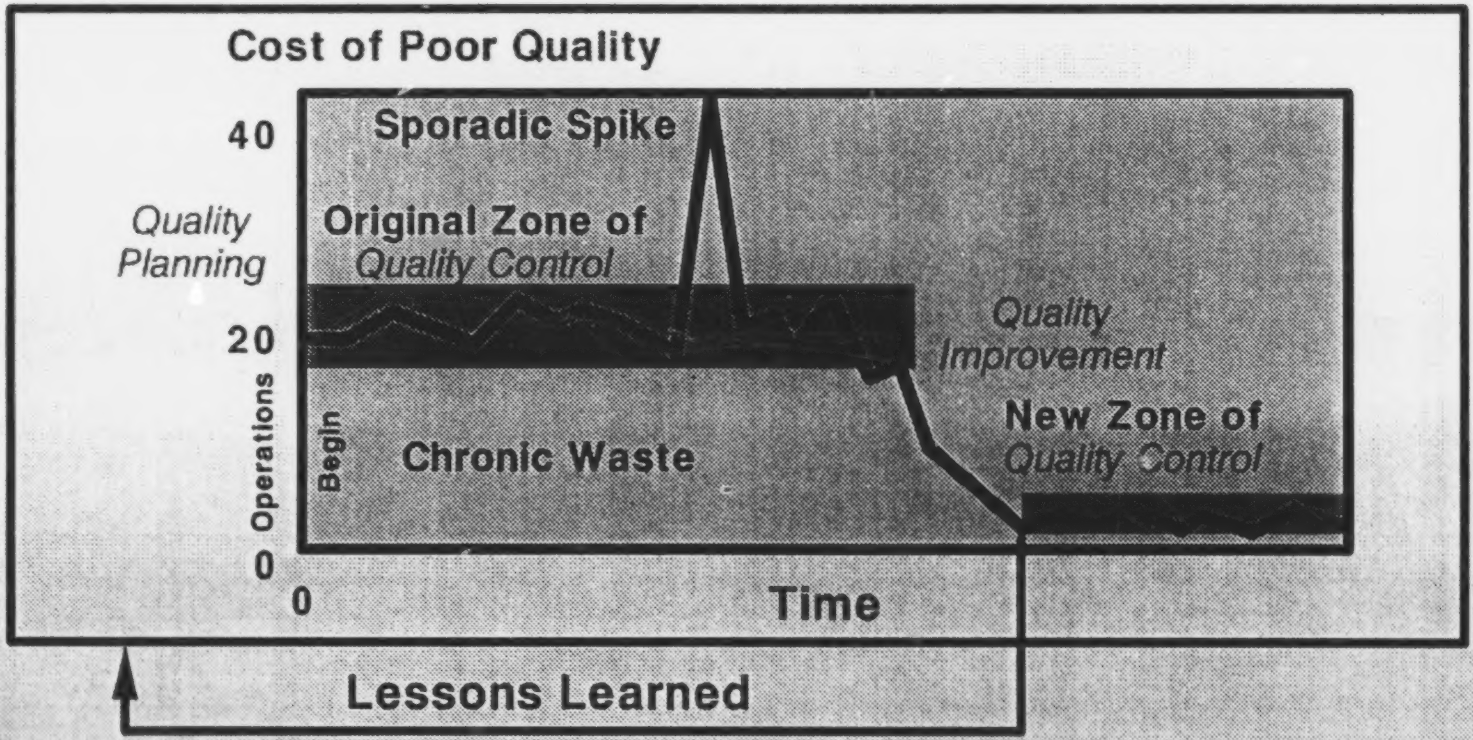

Cost of Poor Quality
40
Sporadic Spike
Quality Planning
Original Zone of Quality Control
20
Quality Improvement
Operations
Begin
Chronic Waste
New Zone of Quality Control
0
0
Time
Lessons Learned

Exhibit E

AFTERNOON SESSION

Mr. Caplan:

Well, if we can reconvene, we have now recovered from our equipment problem, so considering that quality is the subject matter of this seminar, I think we have illustrated to you, not necessarily by intent, the concerns for quality in our society that we have been trying to emphasize to you in this discussion, and that being the case, we want to address a specialized branch, a somewhat different industry now.

Bill Golomski made the point earlier, and Blan echoed it, that there "ain't no such thing as a different industry," but in fact there are some things about the software business which render it a bit unique, and to address those subjects we have asked Dr. Basili, who is chairman of the Computer Sciences Department at the University of Maryland, to talk to you a little bit about software quality fundamentals. Vic.

Presentation: Software Quality Fundamentals

Dr. Basili:

I agree with what has been said so far today. What I am going to do is to try to map some of the concepts onto the area of software development and tell you about specific problems in the areas with regard to achieving quality.

I will begin with four issues that I believe are key problems with regard to software quality. Most of them have already been mentioned, but I am going to give you maybe a slightly different view.

The first issue is that we need to define quality operationally, relative to the project and the organization. If I am going to build software, I've got to define what I mean by quality and that turns out to be an absolutely non-trivial process. In fact, more importantly, I have to define quality operationally, which means in a measurable way. I have to define it in such a way that I can use it to motivate what I mean by software quality, so that I can use that definition of quality to evaluate software, i.e., so that when I am done I know I got it or I didn't get it. Then I can use that definition to build models of the software process and product, so I can do prediction.

The second issue is the recognition of the intricate relationship between quality and the process. Software is a very primitive field in a lot of ways. We are learning about methods for developing software, and we are not very far advanced. But it is clear, given a set of goals for software, then I have to find the processes and methods I am going to use to develop that software to meet those goals.

The third issue is find mechanisms for evaluating software. How do you do evaluation? The first process step is definition. That is hard, but it is not nearly as hard as evaluation, because evaluation has to be done in a context, and I have to make sure that the scenario and the context in which I am going to do the evaluation is correct.

And then the last issue is to create an organizational scheme so that I can deal with evaluation within that organization.

Why are these four preceeding issues problems for software? Why is defining quality, for example, a particular problem for software? I will give you three reasons predicated on the difference between software development and hardware manufacturing. They are: the nature of the process, the difficulty of what we are trying to accomplish and our lack of understanding of the process and product, and the fuzzy expectations for outcomes.

And the first one says that software is different. This is development versus the production process. So, for example, if I were to think about this in an engineering sense, it is not a production line where I am building a whole series of widgits. It would be taking the engineering process and trying to measure the process of creating the first prototype of the series of things I am building. It is the major difference between hardware manufacturing versus software manufacturing. It is a major difference.

Also, software is not visible, which turns out to be a very dangerous thing for software, because it gives you a strange feeling about what it really is. So some of the traditional ways that we would view hardware manufacturing because we can see the product are different from how we would view software. It isn't really production in the normal sense of the word, and it involves a non-visible product.

The second major point is that software is difficult. That may sound like a strange statement to make, and this is something I would say internally to the software business people who don't understand that necessarily. That is, there has been a feeling in the business that software really isn't very hard, that it is easy to build software systems, and I am going to argue that that is absolutely, positively, unquestionably not true.

There is a complexity issue that we get into when we are building software that is a little hard to understand. Let me give you a couple of examples of what I mean by that. In the first place, it is one thing to write a 20-line program. Anybody can write a 20-line program. We teach this to kids in high school. That is different from what we mean by software development: building a production system that is large, that has all kinds of complexities associated, that is integrated with other pieces of the system, that is well documented, that has all the things I need. That makes it a very hard problem.

Worse than that, there is a lack of understanding that it is a hard problem. My favorite story about that occurred when I was teaching a freshmen course in computer science at the University of Maryland. Our course is very mathematically oriented, and it is a tough course. We build mathematical models of programs and teach students how to reason about programs using mathematical models. A student came in to me, in the first semester, after the first exam, and had gotten a D on that first exam. He was very upset and said, "I can't understand why I got a D." So we talked about what he did understand and what he didn't understand. Halfway through the conversation the student said to me, "I know I am a first class computer scientist." And I thought to myself, if I were a chemistry professor and this kid came in, first semester of his freshman year in college and said to me, "I know I'm a first class chemist", I would have just laughed. But he said computer scientist, and so it is not so funny. Is computer science a science? Is it an engineering field? And the answer is, yes, it is! And just because someone understands how to use a Gilbert chemistry set at home doesn't make them a first class chemist. Understanding how to program at home doesn't make somebody a first class computer scientist.

There really is a technical discipline, an engineering discipline. It is very complicated. And the problem is, as Rodney Dangerfield would say, software engineering doesn't get any respect. It is not understood. And I don't mean just by the outside world. Most managers don't understand the complexity of the thing they are dealing with, and that is one of our problems.

Software is difficult for a number of reasons. First of all, what is the software? We are building a system. What is the software? It is the part of the system we least understand. That is why it is software. If we really understood it well and it was organized, then it would be part of the hardware.

Second, we are always doing something new, so first of all we have trouble estimating. If we have done it enough times then we can turn it into the hardware, but we are always building something new, and that is complicated.

Third, we have a lack of models, especially tractable models, for almost any product or process with which we are dealing. That makes it hard.

And last but not least is, software (whoever gave it the name "soft" did us a disservice) has a constant requirement for change, and we really do not understand the implication of changing a complex system, or what happens in terms of the entropy or the unstructuredness of that system as it evolves and changes.

The third major problem we have is fuzzy expectations. Given what I just said about software being difficult, then the software development process is fuzzy. We have fuzzy expectations in terms of poorly defined methods, usually very poorly defined requirements. We must interact with the users. Who is the user? How well do we understand what their needs are? Very often we build something because it seems like a neat idea. And worse than that, in many cases, we have reached a level where people accept poor products. They accept poor quality. We have made the public believe it is okay to have poor quality. How many times have you talked to someone on the phone and they say, well, it was the computer. Oh, that's okay, if it was a computer error. We know they make mistakes.

So that is the nature of the business we are dealing with.

I would like to discuss a couple of key issues. One of them is, we have a standard process we talk about when we build software, and there is a standard, what we call a software life cycle. This is an example of something we don't fully understand. We view it as starting with some kind of requirement: here's what the problem is. And then we carefully specify in some notation a specification. Then we design a solution, code it, and then test and evaluate it. That is how we say we build software.

The problem is that we always talk about the process, not the documents. That is the first thing I think we do wrong, because there are lots of process models. The minute you standardize on a process model, you are in trouble. We need to standardize on the set of documents that you are creating, and then you can find lots of process models, depending on what qualities you want those documents to have, or what you want the product to be. This view gives the flexibility to manipulate process and product together.

One of the things that you heard both speakers talk about this morning was the relationship of process and product and the need to manipulate the process based on the product. That is something in the software business we are only now beginning to understand.

What is wrong with the way we interpret the software life cycle? Let me just give you a couple of problems. The first one is, again, those processes; what are the basic technologies in the software business? I am going to tell you that one of those basic technologies we have in the software business is reading.

I write a requirements document and someone has to read it. If I write a specification document, someone has to read it. The same with a design document and a code document. We used to think, years ago, that writing programs meant we were communicating only with a machine. That is not true at all. It is sort of a side effect. We are really communicating with people who have to maintain the system, use it, understand it, modify it, enhance it, et cetera. So, how much training do we do in what I would call the most basic technology of software, which is reading? Do we teach people to read?

How many people have had a course in programming? Okay. So you can answer this question. How much time did you spend reading as opposed to writing? Okay. Zero. Suppose I said to you, we are going to teach everybody a foreign language. Okay, everybody, start writing. Don't read anything. Just keep writing, and eventually you will get there. And then we wonder about this issue of quality. How do you define quality in the first place? By good writing. What is your model for writing? We know from an educational point of view the best model for writing is reading. And if we have never learned to read, wow, are we in trouble!

So in a sense what we have in the software business is a large number of what I would call software illiterates, people who can write but they can't read. And so that is one of the first fundamental problems we have with software quality. And part of it is an educational issue. We don't do the right kinds of training. We don't do the right kind of education. In fact, it is more complicated than that. I read very differently for different environments. People write for an audience and I want to read that way. There are lots of ways, for example, of reading a program. I can read a program sequentially. I could read it by abstracting function, then recognizing it in hierarchies. I can read it by tracing paths, because there is control flow in this program. Which techniques do I use under the circumstances?

I read from a perspective. I am going to read a requirements document. We have already talked about who is the producer, who is the consumer. We have a model we talk about, the producer-consumer model. Who is the producer, the person creating this document? We talked about the life cycle being a series of documents. I produce this document for an audience, a consumer. Who is the consumer and what is his or her perspective? How do I read a requirements document, for example, from the point of view of the developer who is going to develop the system, versus the maintainer of that system, versus the user of that system? And are those reviews done? What qualities does each look for? Not only do we not know how to read, we don't even have good methods. We have not been trained for that reading. The processes aren't well understood because we don't even understand the basic technologies, we don't educate and train for them, we don't even know how to combine them into a larger process. Reading is a technology that needs to be combined into a method to make it usable and manageable and measurable. How do I do that? And how are the technologies and methods changed for the environment? Another problem is that all development environments are different. I don't have a standard manufacturing plan. It always looks a little different. People have different backgrounds, different equipment, different needs, and maybe different quality goals for different classes of products.

This leads to another problem we have in the software business. People really believe that software is software is software. That is, there is a belief that all software is similar. That is a dangerous thing. It would be like saying hardware is hardware. It doesn't matter whether I am building satellites or toasters. I'd use the same methods, the same tools, the same training. Well, that's absurd. It is also absurd in the software business. Do I train those people differently? Do I use different methods? Do I adapt them differently in different environments?

I started off this talk saying that I was going to talk about the software business and software quality issues. So where am I going? I am trying to argue that the quality concepts that you heard this morning are valid for the software business. The problem is, the software business isn't organized for those quality concepts.

What I mean is, we have to re-understand and re-think the nature of the software business in a way that makes it work in a quality oriented environment, because everything that was said this morning is right. And the nature of what we are trying to do in the software business is wrong. We scaled up a business that is only 30 years old (think about it, 30, 35 years old) and we scaled it up all wrong, so it wasn't geared to quality. Quality was never the driver. Innovation was. Someone who could build something and make it run for a short time, that was the winner, that was the person who got rewarded, that was the organization that got rewarded. And now we are discovering, much to our chagrin, that you can only do that for something so big and for so long a period of time and maintain that for such a time and then it comes crashing down around you.

It has taken a long time to convince the people in our business, I mean the software business, that they are in trouble. They are looking at the wrong things and that they are on a path which isn't going to take them up slowly, it is limited. It is taking them down (I am thinking about Blan's chart) because they don't understand as they are hitting new strides and complexities. The approach they are using which says, "stand on the floor and jump as high as you can", won't work. The approach that has to be brought to bear is one that says learn, learn fast. Learn how to train and educate people how to do it better the next time.

Several professors at the University of Maryland did a study that was supported by IBM a few years ago, and we looked at U.S. and Japanese companies in the software business. What we noticed was that American companies were not doing post-mortems. They would build a product, and not ask what they did right or what they did wrong. What they did was hurry on to the next project. There was not only no feedback, but there was no learning process. Now, I don't mean to imply that feedback and learning are easy. They are not. Part of the problem with feedback is you have to know what you want fed back. And when we are in a primitive technology, it is hard to know what to feed back. One of the things we need to talk about is, how do you set goals and how do you turn them into measurements based on models of the processes, products, and people and how do you learn what you've done right and wrong and where do you make improvements? That is Number One.

The second issue is that the life cycle view we just discussed has major pieces missing. First, how was the user represented? Indirectly through a requirements document. Somehow there was a process carried out that made the user understand that what we wanted to build was not represented in in the process model explicitly.

The process model was very introspective. The process model said: "assuming I know what the requirements are, what do I do?" It was written from a point of view of the developer, not the point of view of the user.

Second, where and how is quality control represented in that process? Where were the checks? And the last issue is that process and product qualities are poorly articulated. What are the goals of the process and product, and how are those goals tracked through the life cycle?

Let me give you some general goals for software development. The first one is a goal written from the point of view of the manager. The manager's goal is to develop a set of documents, e.g., requirements, design, code and test documents, that all represent the same system at some point in time. That sounds like a very simple-minded goal. What I just said sounds obvious except, if you know anything about the software industry, that never happens. The requirements exist, and then they get changed, but no one updates them, and before you know it the only thing that represents what the system really does is the code that runs on some machine. And so someone has got to go ahead and maintain it when they don't even know what it was supposed to do in the first place.

A second goal, from a user perspective, is to develop a system that satisfies the user needs with respect to functionality, quality, cost, et cetera. How is that checked? How is that guaranteed? Where was the user in that process to begin with?

If the user is an educational organization that wants educational support systems, how do they make their needs known? How do educators get the kind of software that they want built? Who is asking them what they want? How do they know what it is? And how do you get it so it is a quality product? Who is articulating the needs of the educator? Users must carefully articulate their needs and interact with the developer to assure their needs are understood and the feasibility of their needs evaluated.

Another goal is from an organizational perspective. If I built the system once, I should be a lot smarter. The goal of any organization once they build something is that they should get smarter, and the next system should be better and cheaper. This is impossible if there is no learning and feedback process involved. That, in my mind, is a classic problem that we have in the software business, that we are not learning from what it is we have done before.

I said that goals for software quality weren't carefully articulated. I want to give you an example of what I mean by that. If we are writing a requirements document, what are the goals of that activity? What are the goals of the requirements document? How would I specify the criteria by which I am going to evaluate whether I have done the right thing? The benefit of stating those criteria is that they not only allow me to evaluate, they allow me to tell the person who is writing that document what I expect them to do and how it is supposed to happen. If I think about what the goals of the requirements activity are, which are to try and capture what it is the user really wants in the system, then what am I doing to make that happen? What does it say about user input, for example? From a developer's point of view, do we send people to the customer to see how they do business? Do I go there and watch the nature of the business and say, ah, that is the way you do business so what you really would like is something that does this? Do we get the user involved in requirements definitions and evaluating prototypes or even testing the system?

Do we create models of how the customer uses that system so that we understand how it is going to be used and how it could be user-friendly? And if the answer is, we don't, then we have lost quality from the beginning.

I want to raise that life cycle process model one level and talk about what I will call the quality-oriented software life cycle. Step One. The first thing I want to do is characterize my environment. That is, describe the environment in which you are working, understand it quantitatively, that is, what kinds of errors do I make? What is my application? What are my resources? What kinds of equipment do I have? What class of product is this? Which methods am I using as part of my process to develop this software so that I can understand it better?

Step Two. Once I characterize and understand my environment, I set my goals. Here is what I want to happen. I might want certain characteristics for the software, a certain level of reliability, a certain aspect of user friendliness. To help set these goals we have a paradigm we use, called the goal question metric paradigm, in which I take the goals, generate questions, and then come out with the actual measures based on what it is I am trying to make happen so that I know whether or not I have achieved my goals. I can't just say I want it to be user friendly. I have to tell you exactly what I mean by that in a measurable way.

Step Three. What are the processes I am going to use to achieve my goals? I might choose methods or tools or techniques or processes and combine them in different ways. I may iterate through these first three steps. If I were to map this into what Blan talked about earlier, this is the planning stage. These are the things I have to do in planning, and it dominates everything I do. When I do planning, I certainly want to reuse. I want to learn from prior experiences. For example, I don't want to recreate measures over and over again. The assumption is, I have created a data base of measures and I should reuse that data for evaluation and building models.

Step Four. Then I go through the process of actually building the system, but building the system driven by those goals, using those methods and evaluating, not just the products, but also the processes that I am using to make sure they are the right processes, providing feedback in real time. That issue was raised this morning. It is an absolutely critical thing. I want to know as soon as I have done something whether I have done it right or not.

Step Five. Finally, I want to do a real analysis, both in real time and as a post-mortem at the end of the project. I want to write lessons learned documents and incorporate information I have gained from building the system into my environment so it becomes part of the characteristics of my environment. Then, when I start all over again, I am smarter than I was the first time that I went through that process.

This is different than what we described as the standard life cycle. First of all, it raises the level. Step Four in the quality improvement paradigm allowed for any process model for development. When I plan software I have to think about choosing the appropriate model for development.

Second, it is not a bottom up process, it is a top down process and requires top level commitment. There was a discussion this morning about commitment from the top. Everybody has to agree this is the way it happens. There is no choice. It has to permeate from the top.

Third, you don't evolve into this paradigm. It is a revolutionary process. That is, to get from where we are, at least in the software business, to what this paradigm implies is a revolutionary process. That is the bad news. It is not going to happen on its own. Someone must make it happen and that is why the top level commitment is really important. It is revolutionary because we need to think differently. We need to train people to think differently.

The quality improvement paradigm is just the scientific method applied to software. I must understand the domain, establish some sort of hypotheses, which I called goals and questions, the things you want to understand, go through the process of measuring and evaluating using the appropriate procedures, decide what it is you have gotten, learn something and start all over again. The object we are looking at isn't something in nature. It happens to be an artifact called the software product. But that is what we are doing. We didn't invent something brand new. It is just the scientific method applied to software development. And that is what quality is about. I am trying to understand what is right, build models of understanding.

So we need to think differently about software, we need feedback, we need to learn, we need to test hypotheses as we go through development. That is really what we are talking about. Maybe the words sound different, but they are the same things I heard this morning. The process can be achieved in small steps. The nice thing about it is an organization can start a certain project or series of projects in this way to learn how to apply the method. There is a learning process associated with application of the method that we are talking about here.

But the good news is, once you are in that paradigm, the later stages are evolutionary. Once I am measuring what I am doing, gaining feedback from it, and learning, I can improve a step at a time. But I can't do that until I put myself in the context of the paradigm. I can't learn from the way we are doing software development now. We are not learning, at least not learning fast enough. The people who are learning are the managers of the people who are on that project. They are not recording that knowledge, that information, for the organization to have or to use in any way, shape, or form.

In conclusion, the basic ideas are to define quality operationally, through measurement. There are lots of definitions of quality, and they not only vary from field to field, but they are going to vary within fields and within organizations. I want to evaluate the effects of methods, tools, and processes. How well do they work? I am measuring not just the product, I am always measuring the process. I want to organize for quality assurance and control by characterizing, planning, measuring, evaluating, and feeding back and improving.

The main issue here is that measurement is used actively. The key issue about measurement as far as we are concerned is it is the enabler of the learning process. Learn about the process and product. And improve the process and product in the appropriate context. There was a statement this morning that every job has two parts to it. One is the doing, and the other is looking at how to improve it. I think that is exactly right.

Thank you.

Mr. Walser:

Thank you very much, Vic.

One of the sad things is that there were a lot of papers in his presentation that he didn't even get to, so maybe some other time we can get some more of that information also.

At this time we are going to do a quick change. We would like to have the presenters of the panel come up to the table. And while we are doing this, if the people on the next panel, on the wrap-up panel, would just visit briefly with Frank Caplan out in the foyer and organize yourselves, then we will just move right on through our agenda and we will get back on our time schedule. I think we will be able to handle it in time.

One request that I would make of you is please use the documents for your written questions. So, come on up, Blan, and take your seat, and Bill. Vic's coming in a minute.

The microphones are also available for you to use. Use them. Questions and answers will begin in a moment.

Question and Answer Session for Presenters' Panel

Mr. Walser:

The first question that I have was to Bill Golomski, from this morning's session. Did you suggest that leadership in change and improvement of quality necessarily comes from outside the organization?

Mr. Golomski:

No, I did not suggest that leadership only comes from outside the organization, but I did suggest that that is one of the places that you should also look for it, because you can get inbred within a given discipline or within a given organization. I think it is well to have people from outside come in, also to read journals from outside your field from time to time, to see whether or not there is anything that might be similar to what you are working on.

Mr. Walser:

Vic, I noticed you smiled. Do you want to add to that?

Dr. Basili:

No, that was just a little comment on my saying I rediscovered a field without looking on the outside, so it is a really important thing. It sounds self-serving when you say that, but I believe it is absolutely correct. There's two things. One thing is, if someone does see the right kinds of things inside, no one tends to listen to them because they are inside the organization. That's Number One. Everybody knows that. And the second thing is that very often you do get a jaundiced view inside an organization. You have been seeing things in a certain way, and then when someone comes in from outside they can say, well, you guys just didn't turn the light on or no one has noticed what was going on in that room. That is just a common sort of thing.

Dr. Godfrey:

Let me add one thing. There is another place that leadership comes from outside, and that is from the customers. I think we all get very shocked when we really find out what the customers think of our work, and that can be outside or it can be inside, as Bill made very clear today, with our internal processes. The next person in line may have a very different view of your quality than you have of your own quality.

Mr. Walser:

The next question is, why do other nations such as Japan seem to have a better reputation for quality products and services? I think that means than us, the United States.

Dr. Godfrey:

Let me start. I will start, because that's easy. It's because their products are better. I mean, let's face it. U.S.A. Today, on the cover, has the ranking of troubles per car, and if you look at the first seven, they are all foreign cars, either West German or Japanese. If you look at Consumer Electronics, most products that we can buy for home, stereo, or even color television now aren't even made in the United States because we haven't been able to keep it up.

It's based on fact and the fact has carried over to perception. A few years ago, while RCA still made consumer electronics in the United States (as you know, they are now a French consumer electronics company), they did a study where they took a Sanyo VCR and they put an RCA name on some and left the Sanyo name on the others. They did this on a university campus, and they had over 900 students and faculty members judge their relative quality. Over 90 percent said that the Sanyo was better and they were identical products. The perception of Japan being better than American is so firmly ingrained that even when they are identical products people believe that.

And the truth is, and we have to face it, in many products, and the problem is it is the most visible products, it's the products we have in our home like the consumer electronics, it's the products we drive. It's not the products we don't see so carefully, like medical equipment, like some of the insides of other products. But in most of those products we have lost the leadership. It has been recognized by the public and Americans are having to make a big fight back. And it is going to take awhile. In some products we have done wonders, but we can't convince the Japanese to quit improving. You know, if they'd just get fat, dumb, and happy we'd have a chance. But now we have countries like Singapore, which has a national goal to educate 25 percent of the population in quality improvement and productivity in the next three years, driven by the National Productivity Board, which is a huge government complex with the most beautiful educational facilities I have seen anywhere in the world.

When you have countries like that--some American industries call them the five tigers; in Korea, where education is still Number One, the top status is still a professor or an educator; where the rewards that AT&T Gold Star gives employees in their factory for doing good work are free education courses at night, and people are honored to be given an extra four hours every Thursday night in technical training, rather than cash awards--we have some tough competition and will continue to have tough competition for a very long time.

Mr. Golomski:

Blan has put this in very strong perspective for us, and I think one of the things, if you were to do a sociological study on, say, prestige associated with professions in the U.S., we would find that the educator has dropped relative to that which we find in other countries. And of course the question is, is that cause or effect?

There are a few industries in which the U.S. still has the world class standard, and of course they are working very hard to make sure they maintain that. Many companies are especially known throughout the world, here and there they might have some products that are being attacked, but I think if you were to take a company like, say, the Eastman Kodak company, whose chairman is chairman of National Quality Month this October, that a goodly number of his products are world class. Some are being attacked by some Japanese companies, and inroads are being made.

And by the way, I would recommend to you that you consider in your various agencies and organizations to be a part of National Quality Month this October, to make that a special initiative. Get together with the rest of the nation and I think it will help you, and it will help all those with whom you come in touch.

Mr. Walser:

Another question, and this one is, Mr. Golomski, probably directed to you. Don't you think you are downplaying substantially the front-end investment needed to assure a successful quality improvement program, and also, how do you reconcile short-term goals, i.e., short tenure at high government levels and productivity, with longer term quality improvement goals?

Mr. Golomski:

Blan, why don't you answer first. You are experienced in education.

Dr. Godfrey:

Bill is going to let me start so he can think some more.

Yes, there is an up front investment, And those of us in the business will say that quality is about the best investment money can buy. But we won't hide the fact that it is a real investment, and when you start talking about training the numbers of people that some companies are training, that is a phenomenally expensive investment.

IBM estimated last year that they spent over $1 billion in training. AT&T estimated they spent over $300 million in training. Xerox has very similar numbers. Phenomenal investments in keeping people up to date on the technology, keeping people up to date on the new quality methods. With the short term look, I think most companies that are really interested in maximizing quarterly profits, we don't have to worry about too much. They are going fast.

The ones that are building for the future are the ones that are talking five-year, ten-year plans. The ones that are talking three to five years just in the training plan for the basic fundamentals of managing quality. I think you are seeing more and more top companies, and Bill listed some of them, American companies who are still above the curve, maybe still having some change of leadership, and they are fighting very, very hard.

You are seeing more of that view. I don't think we have it nearly as solid as the Japanese. We don't have it as solid as the Europeans. I was just party to a discussion in Europe where they are talking about training the top managers, the people that are going to be managing directors of some top European electronics companies. The training program they are laying out is two weeks a year for five years. I haven't seen Americans thinking that way yet. But I think that will change very, very rapidly.

Mr. Golomski:

I think the whole matter of cost is always relative, and it is relative to the benefits that you get, and in organizations there are several ways to measure the benefits. One is in terms of employee satisfaction. Now, does that affect the bottom line? Well, it might be difficult to measure. Maybe it will reduce the turnover of employees.

Secondly, your customer satisfaction. Again, even in government enterprises your constituents are very important. Greater satisfaction there. Then we can talk about the usual ones we talk about in industry, cost reduction. That will apply to you as well. The question is whether it will apply in the first year enough to offset the cost of education and training or not. It all depends on how rapidly you go through the organization.

One of the things I like to do is not move through an organization rapidly, but to move to a given level and then hold until there is complete buy-in in some kind of activity. When you have that, move to the next level. It takes a little longer, but your goal then isn't educate everyone, but simply to get some results as a result of the education.

Now the last, which governmental groups probably are not concerned with to the degree that industrial companies are. Industrial companies are interested in revenue enhancement. I don't know what that means to you, if that means a larger budget or what. But anyway, those are the criteria. Those four criteria are the normal ones that are used to measure the benefits, and for the most part industrial programs will find that within the second year, sometimes within the first, you are getting a payback.

Mr. Walser:

Another question is, what have the quality sciences done with respect to the assessment of quality in the work of agencies or organizations providing elementary or secondary education, and with what result?

Mr. Golomski:

None, to the best of my knowledge on any broad scale. I think there are little activities here and there in elementary and secondary education. Some school systems are trying this out. As I mentioned, the National Council of Teachers of Mathematics has two programs, one establishing standards according to various grades for content, and then secondly trying to have a statistical literacy program brought into the schools.

Mr. Caplan:

I can add one point to that that this gentleman may not be aware of. The state of New York Regents Board has, I guess about five years ago, informed the school systems in New York state that they were going to institute questions on the regency examinations associated with probability and problem-solving, starting with the first six grades and then moving grade by grade up through high school. That process has started, and I don't know what the results are, but the measurements are beginning to be seen in a limited portion of the quality sciences. Recognize that this is just one relatively small part of the total, but at least that effort is taking place.

Dr. Godfrey:

Let me add one thing. That was news to me, too. Thanks, Frank. And I know of very few examples of anyone doing anything, but one of the interesting things was, in a poll of high school students of things that they would be interested in knowing how they are done and the methods behind them, of the top three--you will have to forgive me, I have forgotten the third--but the other two were polls themselves; how can Gallup take 2,000 people during the Presidential election and predict within one percent who is going to win and so forth? That fascinates students, and they are very curious about how this is done. And the other, believe it or not, was quality control. How do companies actually make things that work were things that came up. And speaking of needs or wants that were not addressed, we are actually getting requests from our customers to start.

Mr. Walser:

Excellent. I would just make one comment; the question really hinges around the reason why we are having this exploratory seminar in the first place--to get some matches, if we can, on customer reaction and action requests for quality.

The next question is, what role do you see private career schools playing in the education and training of Americans who "missed the boat" as far as public education is concerned?

Mr. Golomski:

As far as what?

Mr. Walser:

As far as public education is concerned, probably from the viewpoint of public education. How do you see the private schools picking up and dealing with some of these quality issues that we have been talking about, the private, for-profit technical schools maybe.

Mr. Golomski:

There are a couple of aspects to this. One is the for profit schools that you are talking about, but the other aspect is the short term or maybe longer term in-house educational programs that most companies have, at least the better companies. I see more of the activities in that area, where they are relying on expert external help rather than utilizing for-profit, external vocational schools or training schools of that sort.

Now, that doesn't mean it couldn't change, but I think in some cases some of those schools haven't had the faculty who understand the subjects well enough to be able to do the kind of job that the three of us have been talking about: to bring people up to a higher level of competence.

Dr. Godfrey:

I don't know that much about the for-profit end of that, but as far as the community colleges and technical schools, one of the best examples of bringing them in, in a very active role, I think, is out on the west coast with Hewlett Packard. They started using technical school professors and local high school teachers to teach in-house company courses, sharing their materials, their methods, and reviewing and very carefully qualifying these people. And then when they became very satisfied with the jobs that some of these people were doing, then contracted it back to the technical schools to provide the training for their work force. And they built a very strong partnership that is now carried on, I think, in about its fourth or fifth year.

Mr. Golomski:

I believe Ford is doing something to this with the Schoolcraft Community College, which is somewhere in the Livonia-Dearborn area, and anyone who is interested in that could talk to Dr. Steve Zayac of the Ford Transmission Engineering Department. I am sorry I can't be any more specific about it than that, but he spoke at the meeting of the National Council of Teachers of Mathematics this last year in Chicago, together with a high school teacher who is working on this program with him. Ford has allowed a number of the high school teachers to sit in on the in-house training programs, and also some retired teachers, so they could eventually help with some of these activities.

Mr. Walser:

This next question has to do with the application of quality sciences to the process of education versus exposure of individuals during the process of education to the quality sciences, and the question is: are individuals on the program and the sponsoring organizations in accord as to the meaning of National Educational Quality Initiative, which this conference is billed as? The presentations make it appear to be a marriage of convenience with each partner having an agenda where the hidden part of the agenda will doom the effort.

Now, I hope I did justice to the question--if not, the questioner can get to the microphones.

Mr. Golomski:

No, I would say that even though we did not rehearse and agree what each of us were going to say, we exchanged outlines. Although our terminology in some cases might be a little different, I think the quality sciences are an emerging field also, and so if there might have appeared to be rough spots, it is just that we might characterize some of these problems in a slightly different way. But I think, in terms of substance, we have a lot of agreement.

Dr. Godfrey:

I saw no disagreement with what is now the panel, but maybe another way of answering the question is, if I had a hidden agenda I have also hidden it from myself. But I was struggling with the whole purpose of this conference, and I didn't get to all of my slides, and the last one I had was the steps that we see in basic quality improvement and developing a quality system. It starts with awareness and goes down through many of the things, some of the things I talked about, and then it gets down to the last ones, which are standardization and audits. One reluctance I had to come to this conference, as Frank Caplan will agree, was when we heard that there was very much interest in accreditation and standardization, and we felt that we were being invited to work with the American National Standards Institute and stuff, rather than work with quality, and I thought that standardizing was not the way to start. First we have to understand what we are really doing and why we are doing it, and we have to include and we have to have models that we really are very proud of, and then try to bring the others up to that level rather than, as someone said, I think it was Bill, having an accreditation program that guarantees mediocrity.

The other thing that I was struggling with in the whole talk was trying to show how some of the ideas that we learn in product development were applied in course development and course delivery, and at Bell Labs when I was in the Quality Theory and Technology Department, we never had training and education. That was part of the education and training center. And we were very unhappy with some of the things they had done, and when we started some of the courses for changing the way AT&T made products, we did not even ask the education's involvement. Now they have become partners, and now they are teaching some of the courses, and co-developing others. They had to change many of the things they were doing.

When we started developing these courses and looked at the process we had for course development delivery, it was so different from the way we developed the product that we were shocked. We had no real good understanding of the users. We didn't understand what people did. We didn't understand how to get their feedback. We had no reviews of the course as it was developed. We had no checkpoints. We didn't have peer reviews and we didn't have reviews from the customer. We didn't have a project development methodology for courses. All of this was developed, and we kept thinking we were playing catch-up, because every time we'd look at something we'd say, my gosh, we'd never develop a product that way. And half my department developed software, and we'd say, we don't even develop software that way, and you know how far behind we are in software.

And we were trying to bring our educational standards up to at least our software standards, you know, trying to get toward hardware, and we were way behind. And once we started making some exciting progress, we found out the education center had been doing some very similar things, and we paired off, and I think made a lot of progress in applying the same product and the progress development methodology into the product of the courses and the process of delivering the courses. That is what I was trying to show. I think this will work. There is not a whole lot of evidence around the world that it does, but there are companies other than Bell Labs and AT&T that have been doing this.

Mr. Walser:

There is a term in the worker motivation literature called discretionary effort and it is that job effort or potential effort available after the person has performed sufficiently to keep from getting fired. Isn't worker performance quality primarily a matter of motivating workers to use discretionary effort in their job, and doesn't this seem far removed from secondary school education?

Dr. Godfrey:

Let me go after this, because this is one I had a fun time with on the Wall Street Journal report, not too long ago, with Tom Pedricks, the author of Thriving Chaos, because he was into the people, people, people is all quality is about. And that systems were all unnecessary, and it was really motivation. I just had a real problem with it and, you know, we heard Dr. Greer start off this morning talking about his son who didn't want to strike out, but he didn't want the knowledge and the skills and the tools to keep from striking out because that was a lot of effort.

We have American companies just full of highly motivated people from the best colleges in the world working until midnight every night. We have people averaging 70 and 80 hours a week in the Denver Bell Laboratories for years, on some of the products that they are competing with. People are working very, very hard. They are trying very, very hard. They often don't know what they are doing. They often don't have the skills, which is really practice, which is really doing it over and over again the right way.

Bill Conway, who used to be chairman of the Nashua Corporation, gives a beautiful example of this. He says you take two employees and bring them in the room, and say, we're going to have a contest. The prize is a trip for you and your wife, you and your husband around the world, all expenses paid, first class travel, anything you want to do.

He says, the game is who can screw the screw in the board the fastest. He says, John, here's a screwdriver, go to it. Mary, here's a screw, good luck. He said, who is going to win? The guy with the screwdriver. He has the tool necessary, and he probably knows how to use it, and all that sort of stuff.

He says, both of them are highly motivated. Both of them really want that trip around the world. But you have got to give the people the knowledge, the skills, and the tools. You know, my example that parallels Dr. Greer's is golf. I get beat all the time by my brother-in-law. I really want to beat him. But he plays at least once or twice a week. He takes lessons from a pro who happens to be his friend. I play three or four times a year, and yet if I am really going to get serious about that, I am going to have to learn how to play golf. I am going to have to practice, and maybe in some organizations there isn't the motivation, but that is not what it is all about. Recently I got a brochure in which everybody was concentrating on motivational programs, as if that was the solution, and it isn't. It is part of it. So I think this is a multi-faceted problem, and to get at single issues I think is a huge mistake.

Mr. Walser:

We have about two minutes, and we have four more questions, so what I am going to do is read the questions, and maybe get a real quick answer on each one with the idea that if that is not satisfactory to the questioner, maybe right after the session we can still have that interaction.

Dr. Basili, every analytical comment that you made in your discussion of differences between software development and production manufacturing models applied directly to K-12 education explicitly, perhaps to all aspects of education, and points up an intensive difference between industrial training versus education.

Dr. Basili:

I absolutely agree. In fact, I am sorry I didn't make that comment myself. And there is a wonderful example. I think that what I am saying is that the solution for software is harder. But you have to set goals and, of course, you have to go down and try and make them operational, and then collect data and see if it is working, et cetera. I would argue with companies that never collect an ounce of data and just sit down and try to set their goals and try to think of what that means operationally, that they haven't made enormous strides. I don't think we do that now, and I think that is actually even true for education. We don't really worry about it, and it is not a goal. There is a large number of practical goals. How do you set them, and how do you train? Define what they mean in an operational way? That is a very, very hard thing to do, but even only partly succeeding is a very instructional thing.

Mr. Walser:

Next question, Dr. Godfrey. What, in your opinion, is needed in the federal government to improve quality planning and improvement?

Dr. Godfrey:

I hope I will find out next week. As some of you may know, the Federal Quality Center is having its first annual Federal Quality Conference next week out next to Dulles Airport somewhere. I think it is completely booked with a thousand and some people coming. They are launching a big exploration on how these ideas can be explored widely throughout the federal government. Many people have already taken leadership, in the DOD, in the Air Force in particular. I mentioned the IRS, BLS. Many are already moving, and I think this conference next week is to try to explore this, try to focus on some things that can be done, and try to get some kind of resources for the federal government employees to make this happen both with the management and at the work force level.

Mr. Walser:

The next question. You sound like you are familiar with the term in education of qualitative "program evaluation." Can you compare or contrast quality sciences?

Mr. Golomski:

Compared to what?

Mr. Walser:

Qualitative program evaluation, a term basically used in education, contrast or compare that to quality sciences as you have been talking about them today.

Mr. Golomski:

Yes, sure. There are two aspects. One is, when I talked about quality systems auditing, the parallel is quite a bit the same. It is just the criteria that you use for evaluation are different, and who does it, and how often is different, but in terms of intention they are the same. We think the process can be improved by considering some of the things we talked about.

Mr. Walser:

Thank you. That concludes this section of the presentation. I appreciate very much the panel's responsiveness in answering the questions that were provided. If you gentlemen would vacate your seats, they will be taken by the next group, and then we will move on, almost on time.

Mr. Caplan:

The ASQC has over the last couple of years commissioned a Gallup poll on industrial uses of quality control subject matter and a number of other questions. This past year, the people interviewed were all top management and one of the questions was "who is to blame for bad quality?" Over 60% of the respondents answered, "The worker in the shop."

One of the interesting aspects of that is that Bill Golomski, Blan, I, Joe Juran, and 57,219 other quality experts around the world are quite convinced that the major source of problems is not the person who is doing the work, not the operator in the factory, not the engineer in the design group, and not the employee at the lower levels in any government agency.

The problem is management, and fundamentally we say 80 percent of the problems or 85 percent (the last quote I saw from Ed Deming was 94.6 percent, which is a bit more precise than I like to go usually) are caused by management. "Management" is all those causes that are not attributable to the operator, and therefore we are expecting the operator to do what we, as management, have failed to do. This is the reason that motivational programs by that name are for the birds, because we get people all stirred up and strongly motivated and they can't do anything. The problems that we are asking them to solve are our problems, not theirs. And it is just an impossibility. It leads to enormous frustration. Organizations that have gone that route have almost universally discovered that they are worse off after the program fails, as far as morale of the organization is concerned, than they were when they started the program.

The last session, entitled Panel Wrap-Up and Following Effort Identification, involves three individuals (four in this particular case, because we had to come up with a substitute in a hurry a day or two ago). Mr. Spencer Hutchens, who is the president-elect (as of July 1st, he will become president of the American Society for Quality Control), and Dr. John Burr, who is a vice president of the Society, are jointly substituting for the current president, Doug Ekings, who is not well and was unable to attend this session.

But we obviously have ASQC's top echelon well represented. We have Dr. D. Kay Wright, the Acting Deputy Assistant Secretary of the Office of Vocational and Adult Education of the Department of Education, who will be representing the Department in this discussion, and Ms. Virginia Robinson, who is an education writer and editor involved with the National School Volunteer Program, very much interested in the subject, but more or less an outsider to both aspects of this, who is representing that organization on the wrap-up panel.

We will start with three brief presentations, four in the case of the double ASQC work, to express what they have derived from the discussion we have had so far today, and then we will proceed to talk about what we think can be done effectively on a follow-up basis. And with that introduction, I would like Dr. Wright to start with the first presentation.

Dr. Wright:

Thank you. First of all, it has been a very enjoyable and productive day for me. I have learned quite a bit. In fact, as I sat there and listened to the presentations I thought, I wish I could have a whole course on this. That kind of goes with my way of thinking about what we could do as a result of meetings such as this, and that would be to see if we could get it incorporated into teacher preparation institutions and administrative training. I have been a principal at all levels. I have been a counselor. I have been in education, it seems, all of my life, and I have never had an exposure to something like today. So I think that it was extremely valuable.

I represent the U.S. Department of Education today. However, when I speak to you in more detail in the second part of this panel, it will be in relation to vocational and adult education, because that is my area of expertise, and also I feel that it lends itself very well to the subject today. So I am going to pass on at this point and say that it has been very productive, and I think that the only thing I have to say in regards to the particular presentations is that I think you have raised the consciousness to a level that it needs to be, and from now on we are all going to see who is in that circle, and the outreach and the input.

Mr. Caplan:

Thank you very much, Dr. Wright. Ms. Robinson, please.

Ms. Robinson:

I am going to speak entirely to the issue of elementary and secondary education, K through 12. As I listened to the presentations today, I kept thinking analogies. Yes, I can see how that might be something that could be used, or can it be used in the dynamics of the way schools work. They talked about scrap and rework, and I thought drop-outs. Compensatory education. Do it right the first time. All principles which we have generally assumed do not operate in education. You can't be sure that even if you do it right the youngsters are going to get it right, and some of them are going to have reverse motivations to leave school. And so, I was going along today and I thought I would like to know, for example, the reaction of a quality control expert to a situation which educators frequently rely upon to excuse their failures; they have no control over the quality of the material with which they are working. I think it would surely be a major challenge to quality control science to determine how you have achieved quality control in the absence of control of the raw material, which in the case of education, of course, is the students who come to you with a wide range of provocations.

That brings me, again, to compensatory education, which we now take for granted as part of the elementary and secondary scene. Some children will need to go through the cycle more than once or in fact need to be separated from their peers and taught in a different way. How can one apply quality standards to reaching a wide range of youngsters who we have decided we will separate out from the process? It would be as if a factory had two operations, one for standard materials and one for substandard materials.

I also thought, on the hopeful side, as I listened today that I got a little bit closer to feeling there could be a breakthrough on the education reform scene if some of these concepts could be incorporated. It has seemed fairly depressing to those of us who have watched the overall education picture since the most critical reports came out five years ago that not a heck of a lot had changed. A little here and there, but fundamentally very little change.

Today I got the feeling that maybe, maybe this might do it. Maybe this is a key here, something that could happen that would be profoundly different, and then it occurred to me again that it is very hard to change the dynamics of so huge an institution as elementary and secondary education, and I got to thinking in more specific terms.

For example, a profession is characterized, I believe, by setting its own standards. The practitioners set the quality standards for the profession. Education currently is deep in the question of whether teachers are truly a profession. They do lack that one essential hallmark of a profession. Teachers do not set their own professional standards. They are set for them by external bodies, state accreditation, or certification units, primarily.

So that is an issue that I think will be interesting in quality science as applied to the professions. What is the status of that concept of professional standards and quality control?

I am also moved to observe that it is only very recently that in elementary and secondary education outcomes have been considered a measure of quality. We have used inputs, facilities, degreed teachers, certified teachers, and so forth, to determine whether it was good and successful. Only very recently has anybody talked about the quality of the product, and there the general concept arises again with which I opened, which is blaming product for its own inadequacies. The education system did what it could but the kids didn't have what it took, or they didn't work, they weren't motivated, their parents didn't care, they watched too much television, they've got second jobs after school. You name it. There have been many, many, I will use the word excuses, raised by educators for the fact that they could not control the quality of their product, and I think it would be extremely interesting to have quality control people address this head on.

I mean can you, indeed, guarantee the quality of a product even within the quality control range, which I know is never 100 percent? Can you guarantee it, if you cannot control the material with which you work?

I guess one of the most ironic things that I heard was the comment that quality assurance may take the form of how to do the wrong thing more efficiently. I guess if you were going to have an epitaph for the current education reform movement it would be that. I think that a lot of energy is being spent on how to do the wrong thing more efficiently.

I just hope that maybe apart from those of you who are educators you might be interested in these comments and will encourage our quality experts to think about this. It is a big problem that needs the best kind of thinking that anybody can bring to it, and if you've got anything to contribute I think you should do it.

Thank you.

Mr. Caplan:

Thank you very much. Those are very interesting comments. We appreciate those. I guess Dr. Burr is going to be first up on the quality side, which makes sense, since he has been here longest at the meeting. John.

Dr. Burr:

About two days ago Frank called me up on the telephone and asked me if I would be here today and explained that Doug Ekings would be out of town and not feeling too well, and I said sure, and I hung up the phone. My daughter said, who was that on the phone, and I said, that was Frank Caplan. He asked me to substitute or replace, I don't know which, Doug Ekings and she said, well, what is the difference between substitution and replacement? And I said, well, if you go out into a cabin and you break a window, you if you don't have materials right there to fix it, some of us will put up a piece of brown paper, and put a little X on it, and that is a substitute. Then you can't see through that very well.

Now, another thing you might do is go into town and buy yourself a piece of glass and put that in. That would be a replacement. And she said, I know what you are. I said, what's that? She said, you're a replacement. I said, what do you mean? She said, you're a pain.

Mr. Caplan:

I thought she was going to say she could see through you easily.

Dr. Burr:

I want to take a few minutes just to sort of summarize what I thought were the ultimate key concepts that were presented today. The first one I think is very obvious, that systems, all systems, are processes. That processes can be improved; that improvement never, ever ends; that change must start at the top. Everyone must be involved. Requirements must be customer-driven and, finally, education is a system and it is a process, and we start back with Number One.

Thank you.

Mr. Caplan:

Thank you, John. The next speaker is Spencer Hutchens who, as I indicated to you, is the president-elect of the ASQC, and he got the same kind of phone call that John did.

Mr. Hutchens:

I certainly did, so since John has done such a fine job telling how the telephone call came I don't have to review it with you. I might say, though, that I am from Los Angeles, so it was a little bit more of a problem for me than it was for John to come from Rochester, New York. That is not really the reason why I was late getting here this morning. I had another meeting scheduled, and I just could not reschedule that one totally, so I arrived this afternoon. I was very impressed with Dr. Basili's presentation.

I was very excited when we met two or three months ago to discuss the possibility of ASQC being a participant in this seminar that is designed to explore ways to improve the quality of education. I don't think there is anything in our country that concerns me more today than education. Although we don't have all the answers, based on observations made by our membership, there is a real need for action to improve the system at all levels.

I wonder if our current system can provide the skills required to support the level of sophisticated hi-tech programs expected in the 21st century; will that generation be prepared to deliver the higher skills required?

So I am very pleased to be working here with all of you today. And you will hear from me again a bit later.

Mr. Caplan:

Thank you, Spence. Well, that completes the first phase of what we want to cover in this section. Now, I have asked Dr. Wright to begin the second phase, and of course she told me she had some ideas about what she thought could be areas where the quality professionals in our society could contribute in working closely with the Department of Education. Kay.

Dr. Wright:

Okay. Thank you. First of all, let me give you a little bit of background. This past year I am sure you are aware there were a series of Congressional hearings held on global competitiveness of the United States, and over and over again, as our speakers said this morning, they pinpointed that the educational system was key to turning around the economy and making the United States competitive once again in the global market.

So, with taking into account the hearings and all of the reports that have been issued, the Vocational Office came up with a series of ideas, I will call them principles, that we think would be important to put into place in each vocational program. We are saying these things loud and clear to the states and to the directors of vocational education programs, and we could probably use all of the assistance that we could get in putting these things into practice. Let me go over them very briefly for you.

One is that we want every student to come out of our secondary schools with the basic skills, and I am sure that is no surprise to anyone. But definition of basic skills would be a key area. Everyone talks about it, but what is it? So that would be an area that we could use your assistance.

Secondly, we are telling our vocational program directors that if they do offer occupationally specific programs at the secondary level, and by that I mean job training programs that are very specific, such as technician training in electronics, welding technicians, and so forth, that they relate directly to the labor market, and that the people in the labor market are part of the process for delivering those programs, that they help plan the curriculum content, that if necessary they collaborate with the schools on the use of equipment, team teach with instructors, and so forth.

The third area that we are asking them to work in is to expand partnership efforts with all business and industry. Again, it is going beyond the feel-good sorts of partnerships that were established some years back when businesses and industries adopted schools and gave them money for special projects and for equipment. We really want to blur the lines between education and business and industry, and work much more closely.

Fourth, we'd like to see a lot more planning taking place at the regional and state levels for all entities that are delivering job training. That would be from the secondary schools, to the community colleges, to the area vo-techs, to the Department of Labor, Department of State, the private, proprietary schools that are providing training, to sit down and take a look at what is needed in the region as far as job training, what is available in the region, what is available at what cost in the region, and then try and share resources.

I think we are past the point where we can all go out and buy the latest equipment and duplicate efforts, so we are asking people to sit down and plan regionally.

And the last area, and this is again an area that I think would lend itself with working with your association, is that we are telling the schools that if they offer occupationally specific programs that they should measure the student compentency. If a student is being trained as a welder, or if the student is being trained as an electronics technician, there are skills that should be mastered, and those skills should be demonstrated in performance and also in writing. And so we are asking states to take a look at how they would do that.

In Pennsylvania, I just came from Pennsylvania to Washington, we worked with SOCAT (the Student Occupational Competency Achievement Testing Corporation), to develop tests to measure the student competencies in 34 occupational areas. Those tests were developed with business and industry people working alongside educators to say this is important, these are the things they should be able to do when they leave school and come in at entry level. So these are some of the things that we are thinking about and talking about in vocational education. They are some areas that I think lend themselves to working with your group and with others to see if we can assist the states as they wrestle with these measures of accountability and quality that they are being faced with.

Mr. Caplan:

Thank you very much, Dr. Wright. Ms. Robinson.

Ms. Robinson:

She has just stolen my two key words, which were accountability and quality control. I think if I would ask one simple thing of the quality control message it would be to think about and to provide some philosophical leadership in relating this word, accountability, which is either the hope or the bugaboo of education right at the moment, depending on where you sit, I guess. Certainly the stress is on accountability, and I don't see how that can be divorced from quality measures, quality control, but there is no external value being given to educators on that subject at the moment that I know anything about. And in line with the comments that have been made here today, it sometimes takes an outside expert. It may well in education, I think, take someone from outside the profession of administration or teaching to clarify this really serious word, accountability, that is either going to be the point on which educators dig in their heels and say, I am going to go down this road and you've got all the accountability you are ever going to get, you know, or it may open a whole new way of thinking about the education of those children who are not old enough to be asked, as your engineering students were asked, what they wanted to learn. Somewhere there has got to be some relationship between controlling quality and accountability and so that would be my contribution.

Mr. Caplan:

Thank you very much. Spence.

Mr. Hutchens:

I am sure that ASQC is a resource, and I ask you to please use it. We are interested and we want to work with you. Now let me tell you a bit about ASQC.

ASQC is a non-profit, non-political, non-lobbying national society consisting of more than 63,000 members and 400 corporate members representing every facet of industry and many government activities. There are 120 sections, 13 divisions and 12 technical committees. We are proud that among the membership are the top professionals in the field, including W. Edwards Deming, Jopseph M. Juran, Kaoru Ishikawa, Philip B. Crosby, Armand V. Feigenbaum, and the late Walter A. Shewhart. Most of the quality methodology and management principles now in use were originated by these past presidents and honorary members of ASQC.

The divisions and technical committees sponsor meetings and special events including training throughout the country. Each publishes a newsletter. There is also an International Section that represents those members outside the United States. There are about 2000 members in this category.

Each year since 1948 ASQC has held an Annual Quality Congress. It is one of the nation's most respected technical conferences. It offers quality professionals, who share a common concern for quality, an opportunity to exchange ideas with colleagues from around the world.

In 1984 ASQC initiated a national campaign to capture and direct the attention of business and industry to the strategic imperative of quality improvement. The initiative resulted in a Joint Resolution of Congress and Proclamation by the President of the United States that designated October as National Quality Month.

National Quality Month has attracted some of industry's top executives to serve as chairman of the Annual NQM Forum because they are fully aware of the significant role that quality plays in today's competitive global marketplace. The late James E. Olson, CEO, AT&T; Douglas D. Danforth, CEO, Westinghouse; and James R. Houghton, CEO, Corning Glass; have served as chairmen of NQM. Colby H. Chandler, CEO, Kodak, is the 1988 chairman.

Dr. Wright, you expressed an interest in learning skills. We do understand the importance in learning basic skills. Our divisions and technical committees are designed to improve skills in individual technical areas such as aircraft, aerospace, chemical, mechanical, electronics, et cetera, for people of all ages.

Accountability was mentioned with quality. Yes, they are related. Be it manufacturing or training, the person performing is responsible for doing it right the first time. We can't forget education of the children. Every effort must be made to design learning programs that provide quality education and the motivation for improving the system. ASQC is very desirous of working with you in improving the quality of education. We have many resources that are available throughout the country. Our headquarters staff is available to help identify the resources that you need.

I think that when you talk about accountability being related to quality control certainly it would not be too wrong, I don't think, to say that quality control is understanding that you are accountable for something, that you must make sure that it does happen right and, if at all possible, to try to have it happen correctly the very first time it is manufactured or the first time you do something. I think this might also have something to do with education for the children that we are talking about in the lower grades, in primary school, to make sure they don't repeat grades, you know, to be sure they are learning to do it correctly the first time.

But I guess one thing I would like to leave with all of you today is that ASQC is very willing and we certainly would like for you to use the resource that we have. What kind of resource do we have to offer? I think that it is a very, very broad range of resources that we have and we can certainly work with you once this is over to identify some of those resources that we may be able to offer and have you make good use of.

Mr. Caplan:

I might mention that one of the questions that was addressed to me during the break was, what could ASQC do in the area of support, what could we provide in the area of texts? The American Society for Quality Control has as one of its arms Quality Press. We obtain manuscripts from authors. We commission books. We publish books. We can provide textbook development support in any area and at any level we might mutually decide upon.

It would also be highly appropriate, as far as I am concerned, that we become involved in answering questions of curricula revision cooperatively with the educational community.

As you recall, Bill Golomski gave some of his thoughts as to what level of instruction should be incorporated at different grade levels, and while there may be a variety of ideas as far as that table is concerned, nonetheless it is that sort of thing that we could very rapidly help with, and as that form or format was identified, we could then commission the development of suitable texts in that area.

Now, these might well be developed by some of our members who are already educators in the school systems developing curricula materials for other programs, so that we would not be doing this entirely as an outsider in that sense. We would be dealing with the fact that I would estimate at least 30 percent of our membership, totaling to Spence's figures 15,000 or 16,000 people, are involved with education and training in various ways, and this means that we have a rather considerable resource of people who do instruct in a variety of circumstances. Most of those circumstances are at the junior college, community college level. A number of us are involved in full four-year college and graduate programs. But there is also some small amount, but not very much yet, of the kind of work that Spence mentioned is going on at Corning, where we are actually working with the secondary schools to accomplish this sort of thing.

We can help and we would very much like to help. Actually, we would be a little bit distressed if you went off and did this without asking us to help, because it would be just like we were talking about earlier. Please identify who your customer is and your supplier, and let's all work together to make this product come out the way it ought to.

LeRoy?

Mr. Walser:

One thing that all today hasn't really been mentioned is that we have been in motion, Spencer, that ASQC is the accredited, sponsoring organization for Committee Z1 on Quality Assurance for the American National Standards Institute. I think that's just the work that might be a real opening, and I know that Blan indicated that it is a little premature to talk about standards from that perspective. I would like to broach that topic just briefly and say that forum itself, even though Z1 has a lot of divisions and activities under it, might be an exploratory forum for getting together what the topics of some of these curriculum items might be at different levels of education. That would be a possibility. Am I off base, or is that related?

Mr. Caplan:

Not at all. As a matter of fact, Bill, Blan, and I are all members of the Z1 Committee and it should be, I think, highly appropriate for the committee to address this question as a special task. It is not exactly what we would ordinarily address, but I think it would be something that we could deal with. Any feelings, Bill, Blan?

Okay. The answer is, yes, I am sure we can do it. You must recognize that the Z1 Committee involves somewhat more than 100 members, most of whom are not ASQC members, because the Z1 Committee was formed from a large number of organizations who have an interest in quality, including a number of government agencies, so that there is a tie-in there that might not be obvious.

Mr. Walser:

I think with that tie-in might also be necessary to broaden the customer base or the involvement of other folks who would have a need to have a say in what the outcome would be in education. I think that was also Virginia Robinson's point about how do we get a definition of some of these quality, accountability factors and where do they fit.

Mr. McKee:

I am Sam McKee with the Department of Education. I think the ASQC should pursue the idea that we were just talking about, but I think the major contribution that can be made to education is this process of quality control, quality assurance; this is a coordinated process. The customer, it seems to me, is the 15,000 school districts in the United States. Now, that is quite a proposition, to reach all 15,000 of them and persuade the school boards and the superintendents (in order to get started with their top down management) to adopt that process, but that seems to me to open a door. It seems to me that a combination of help from the Department of Education, the appropriate associations, and the expertise you have about this process, is the way to reach the customers and really make an impact on education.

Mr. Caplan:

Thank you. That is an excellent point. Spence.

Mr. Hutchens:

I agree that that is perhaps an area where we can be of the most help in getting the process started. I also agree that there is a need to identify parameters that we use in quality assurance and quality control that are related to education. We could help develop procedures to control the quality of education at various levels. We would certainly be happy to work with you.

Mr. Caplan:

Thank you. John.

Dr. Burr:

Yes, you recall the old story about when you are up to your neck in alligators, it is hard to remember that your job was to drain the swamp. The question you have to deal with in a lot of cases is that there's a lot of problems and a lot of pressures and stress. And you must try to come in and persuade the top person, in the face of that swamp full of alligators, that this is what must be done. And he or she is looking at that as just an iterative position system, and somehow or other while the enlightenment that may come from outside the organization, I think you are going to find that the impetus for that is going to have to come from a higher authority, such as the New York State Regency Board, or the Department of Education at the national level, or wherever, but I think that is where the encouragement is coming from. That change is going to have to come because the people who are going to be participating in that change are uncomfortable with where they are and, in many cases, I see they are very comfortable where they are now.

Mr. Caplan:

I think that is an excellent point, John, and it is something that I had intended to refer to in response to your comment. I have a very specific and somewhat bitter experience personally with attempting to do exactly what you suggested, not now, not in this case at the local school board level, but at the State University of New York area combined with the Department of Education. New York state, for those of you who don't know it, has two separate Departments of Education. One is called the Department of Education, which is K through 12.

I got these people together, and we had discussions, we had a very, very nice seminar, and we all agreed it was the greatest thing since sliced bread, but for some reason or another it never got carried on. What I then decided was to write a letter to Secretary Bennett saying, look, my friend, the Honorable Dr. Bennett, et cetera, et cetera, we have a problem in this country and we can't get the schools interested, and we need help. And by the way, it was not just my experience in New York, but it is all over the country, with local exceptions, and very, very great ones, but there are very few. We need help. We need some pressure applied. At the college level we have a mechanism, the accreditation boards. And we can deal with them. Dr. Reyes-Guerra, from ABET, was here a little bit ago and thoroughly endorses what we are doing, and we are getting excellent support from COPA and so forth. We are making strides at the college level. We are at a complete stymie when it comes to the primary and secondary schools, as far as being able to address it, because there's 50 different accreditation groups. We don't know how to go about doing this. There is no formal national accreditation function. It is handled by the states. And we are in the soup.

We felt that by taking this initiative and getting this seminar set up we could make some beginnings towards getting this done, but in all honesty we tried the route you are talking about. It is possible, but it has limited success and then only in certain areas and, very frankly, there is enough change-over in school boards and so forth that you have to go back in and re-sell the program every three or four years. And we need to have it built-in so that there is not squirming out from under or just ignoring it completely when the next budget crunch comes.

Dr. Wright:

I agree with what you just said. I would suggest, however, that we work closely with the state departments of education because, as you indicated earlier, each state has its own accreditation standards and so does the state board of education, but they are all concerned with this issue of quality. And they will be concerned more in the future with the issue of accountability; the federal government was making it an issue and wanted to know how to develop measures to demonstrate that they are meeting the accountability issue, so I think that we can work cooperatively with the states. And with the federal position on accountability being stated the way it is, I think some of these things will come about.

Mr. Caplan:

I appreciate that comment, Dr. Wright, and with the exception of Alaska, we have key members in state capitals in all the other states of the country, and we certainly would be more than willing to try to motivate that activity. On the other hand, unless there is some rather clear national directive towards quality as separate but equal to accountability, we are not going to achieve it even by that method because we have people with different skills, different knowledge in these state locations. We are not organized to put on that kind of drive. We can address it and will address it, but it is not going to happen without some very strong assistance from the Department of Education.

Ms. Robinson:

That may be true. It may be that the state is the best way to go, but I would offer you an alternative suggestion. No one is more uptight about accountability than the classroom teacher. I would urge you to take your concept to the major teacher organizations.

Mr. Caplan:

They were invited to be here today.

Ms. Robinson:

Were they? Contrary to the principle which was enunciated this morning that quality control has to be top down, with all respect, that isn't the way education works. Education works in the other direction. You cannot achieve anything unless you first convince the classroom teacher of its value. Quality control strikes me, just off-hand, as something the classroom teacher would find interesting. I really think so. Accountability, evaluation by the principal, those are bad; but something that a teacher would see, some strategies to employ in their classroom that would then be reflected in the evaluation that was made of their teaching, this might be an alternative route to go.

Honestly, state departments of education and, even with its superior clout, the U.S. Department of Education have limited capacity to influence what actually happens in the teaching process, which is, after all, what you are getting at, isn't it?

Mr. Caplan:

Yes, it is, and let me point out to you that what happened in New York state with the Board of Regents initiative was extremely revealing to me.

Ms. Robinson:

Did they make a difference?

Mr. Caplan:

The local school districts went ape. They appointed teacher groups to work over the summer to develop curricula to cover these materials in the classroom.

Ms. Robinson:

Well, the regent is a special thing. The regents' examination is unique. There are states, however, that do have some punitive measures built into their accreditation process, and that might be a similar tool, but I still say that isn't going to make any difference to what actually happens unless you get the practicing teachers to buy into the idea. I am also saying that I think it sounds like an attractive alternative to everything we have got now.

Mr. Caplan:

Okay, we will work that angle too.
You had a question?

Mr. Scruggs:

I think we are making one of the worst mistakes that we can make. We are here for a session on quality. One of the things we are supposed to do, one of the first things, is to identify the customer. The last ten minutes of the discussion have been within the confines of the education community. When you are talking about customers of educational products, the students, you are talking about business, you are talking about universities; when you are talking about the quality of the public schools. You have business expectations, business customers. You have university and college expectations. You have military. All these organizations take the products of the school system, so you need to talk to these people.

You also need to talk to the parents, the PTA organizations, for example. All these people need to be drawn in to establish quality standards for the schools. There are a couple of practical ways that the top leadership of education in the country, the Secretary, the Under Secretaries, and the Deputy for Intergovernmental and Interagency Affairs, that would affect not what we are talking about throughout the country, but within the Department of Education. As a result of this meeting the books that were published at James Madison High School could be re-examined to see whether they were specific enough in terms of student behavior. That is what we were just talking about. Maybe it should be made more specific, drawing upon the various customers of our educational system.

Another thing that the Department of Education could do is to apply the content to the management of its program. There is something that just came out of the Office of Management and Budget called OMB Circular A-132, Federal Quality and Productivity Improvement in Service Delivery. It sets forth all these things we have been talking about today, beginning with the identification of the customer and establishing standards of quality and productivity and timeliness and setting annual incremental goals for improving in each of these areas.

On May 24th, day before yesterday, the Under Secretary send out a memorandum to all senior officers indicating that one of his key concerns is productivity. Now, it is very nice for the Under Secretary to do this, to send out this memorandum to the senior officers. I suggest that Secretary Bennett and the Under Secretaries and the Deputy Under Secretary for Intergovernmental and Interagency Affairs bring together all the senior officers of the Department of Education and meet with them to show in a more concrete manner that they really think this is important; or important enough to merit more than just sending out a memorandum. And then I think that the requirements of this circular should be implemented within the Department and see whether we can do it. If we can do it in the Department, it would make it a lot easier to do it out in the real education world.

Mr. Ullman:

I'm Neil Ullman. There are so many of the areas I would love to make comments on, but one of the things is, you know, you have to talk about education still as a process, and we are talking about some of the intermediate stages. It is true what we want to have at the end of this time. I am reminded in the last couple of comment of Charlie Schultz's recent Peanuts, and the question of fractions now, and she is absolutely up tight and can't remember whether she got on or off the bus to go to school.

At the same time I am seeing things that say, should we teach reading? There was an article in the New York Times this Sunday on should we be teaching reading to pre-kindergarten because there is this high pressure to get children to learn how to read at a very, very early age. Now, we don't have the information. One of the things that has been tried, I think at the same time we were trying all these activities, was behavorial objectives. It was the thing, a few years back, that we measured things and you could see what the outcome was, presumably. We don't really know when is the best time to put our efforts into the education of the children, and this has so much of an impact on the quality. I think we have to be able to get in there and figure out really what the goals are in many ways before we start thinking about testing, know what the basic skills are. I have a calculator that can do fractions, long division. It cost me $10. It is made by Casio. We spend a whole year in education teaching how to do some kind of algorithm, but we don't need to teach this any more because we don't think we need them. I think ASQC can help the education community perhaps in trying to help define the way in which to go about measuring, the way we should go about setting goals and objectives as a first step in defining what the needs are.

On this issue of accountability I think we are way too premature. I think a lot of stuff we talked about in this word "accountability" on teachers or on how it is really destructive to the whole system. I will stop at that point.

Ms. Malloy:

My name is Lynn Malloy and I am with the Nuclear Regulatory Commission. I feel a little out of place in this area because I feel I really don't have a very large appreciation for the type of problems educators are dealing with these days. It has been a number of years since I have been in school and somehow I feel the process served me very well, as it turns out. I think it was Neil that was just talking; I wanted to say a little bit on his comment.

I feel a little bit confused in listening to all of you talk because for most of my career outside college I have been a quality assurance specialist, a QA practitioner, mainly in the manufacturing field, and what I see a lack of here is that I really don't know what is the problem that you folks are hoping to solve. We have to identify what that problem is or problems are. And until you can come to grasp with that, you have to then identify what you think the causes are for those problems before you can even begin to take any kind of corrective action, which is what you are talking about, a systematic approach to solving whatever the problem is.

I think you have more complex of a problem than you realize you are dealing with. Maybe you do realize that you are dealing with it, but you are trying to nick away at one little part of it, and it really is something that is a lot bigger, I think. What I have been getting is that we are talking about the economic situation in the United States, and I think it is a little foolhardy to think that the educational system is to blame for the state of the economics of the nation because there are many other factors that play into that situation. The problem is bigger than just education. But even just to fix education you have to know what problems you are dealing with. Identify those, think what the causes of the problems are, and go after those causes for correction. And you need to know where the power lies in correcting those causes because, contrary to what someone said, I truly believe you are never going to get any corrections unless you can get the level where that power exists to realize that there is a problem and take the action to make sure that the problems are corrected.

And it has to come from the top down if you are ever going to reach some state of correction, and it is not going to be something that you are going to be able to do probably in a year or two. You have got to set some goals as to what kind of progress you want to achieve, and how soon. Set yourself some goals and follow it through.

Anyway, that is all I wanted to say. I wanted to bring it down to a more basic level, because I really feel like we are not hitting the grass roots stuff here, and that's my opinion after 13 years in the field of quality assurance.

Mr. Caplan:

That will be taken into account. Let me point out that we did define the problem. We defined it in a somewhat more limited fashion than calling it the state of the U.S. economy. But the way we defined the problem led us to this conclusion: the entering work force coming out of the high schools, coming out of the colleges, are uninformed in the field of quality; that industry, business, government wishing to accomplish anything in that area has to invest inordinate sums in training people after they have been hired and are not able to get to many of them until after they have produced a large amount of whatever it is they are supposed to do that turns out to be unsatisfactory. That is the problem as we defined it.

This led us to the educational solution. Since the entering work force tends to come to us out of the educational system, we thought we could address this lack of understanding of quality and the quality sciences, quality awareness through the educational process.

Mr. Hutchens:

I would just like to make one comment, Ms. Malloy. You certainly proved to me that you have done a fine job and learned the lesson very well as a quality practitioner. I think you describe the process very well. Certainly we must identify the problem and, as we have found in our society as quality professionals, yes, you must have the attention and complete support of top management to solve the problem. I also agree, of course, with the people who have spoken to the fact that you need to work with the teachers because that is where the process will be implemented. The first step is identifying the problem and then identifying the cause and developing a solution. Certainly in the six hours we spent here today, we aren't going to complete the whole process. It is a start and we must work together to implement the process that will lead to solutions.

Mr. Caplan:

Thank you, Spence.

In the interest of attempting to meet at least one of our commitments when we invited you to the seminar, I herewith declare this meeting complete and finished, and thank you for your attendance. However, there appears to be a post-meeting question. You may leave if you like.

Mr. Kunkel:

This is maybe a topic of closing anyway. My name is Richard Kunkel, and I am Executive Director of the National Council for the Accreditation of Teacher Education, and we are an agency who has been doing a lot about teaching. I want to thank the Department of Education and others for bringing this meeting and these kind of resources together because I see the real large system of resources you can look at. In my group I get involved with teachers, principals, AFT, NEA, school boards, volunteers, all kinds of other people. But here, there is a content in the process that you folks are dealing with that really starts with software. I think this whole focus on things like ANSI and ASQC and the focus on your kinds of operations, how you go about standard setting, can really help a lot. We are working that process already, so don't just look at it to immediately prepare great teachers. Give us a chance to get a system application, and I think there is a lot of good we can do together.

Mr. Caplan:

This meeting stands adjourned. Thank you for attending.